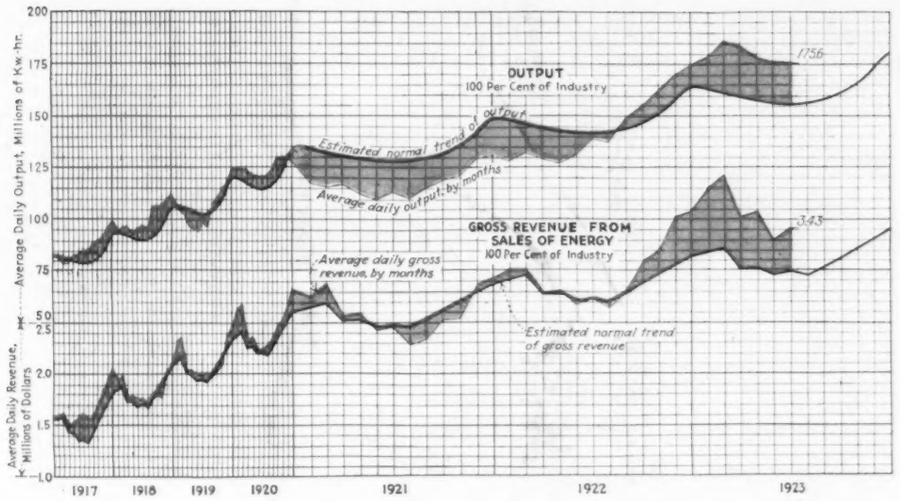
SEP 5 1923

McGraw-Hill Company, Inc.

Twenty-five Cents Per Copy

September 1, 1923

Electrical World



Central station records of the first six months of 1923 indicate a 25 per cent increase in electrical energy sales as compared to the same period in 1922. If this ratio is maintained the year's total will be over 66 billion kilowatt-hours with a gross revenue exceeding $1,300,000,000. Interpreted otherwise, this rate means a doubling of central station output in four years as compared with the previous record of doubling every five years or, as some have claimed, every seven years.

Securing Greater Efficiency in Small Station Designs
By G. T. Shoemaker

Generators for Charging Transmission Lines
By A. W. Copley

Fires and Explosions in Transformers
By O. H. Eschholz

Modern Street Lighting Installations—A Story in Pictures
By J. R. Colville

Tests for Making Gray Iron in the Electric Furnace
By E. L. Willson

Ten Pages of Short Practical Articles on Current Problems

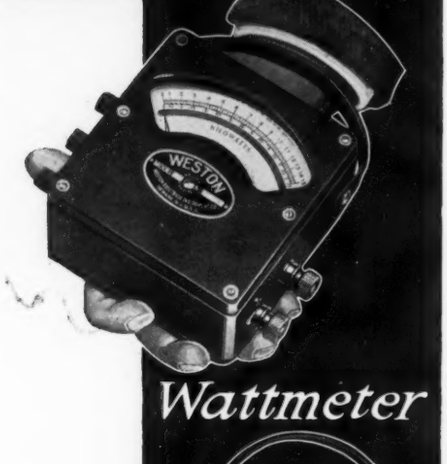
Graphical Statistics Show Generator Capacity Grouped by Sizes of Systems

Digest of the World's Electrical Literature
The Week's News and Review of Business Conditions
Construction News *Electrical Patents*

CONVENIENCE

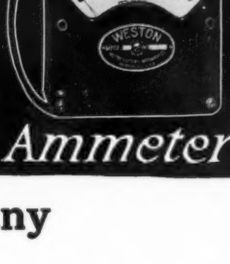
Made by specialists to fill the requirements of all general inside and outside A.C. testing—and to overcome the shortcomings of other instruments of this type.

Convenient—of light weight and small size, making them ideal to carry and use. **Accurate**—offer the greatest accuracy yet attained in instruments of this class. **Moderate Priced**—sufficiently low in cost to make their purchase and use—not only a convenience—but a splendid investment and economy.



Wattmeter

Voltmeter



Ammeter

Weston, Jr.

Portable A. C. Group

Bulletin 2006 fully describes and illustrates this remarkable series of small instruments. Write for it.

Weston Electrical Instrument Company

13 Weston Ave., Newark, N. J.

New York, Chicago, Philadelphia, Boston, Cleveland, Detroit, St. Louis, San Francisco, Denver, Cincinnati, Pittsburgh, Buffalo, Rochester, Minneapolis, Jacksonville, Seattle, Syracuse

Represented by Northern Electric Co., Ltd., in:

Montreal, Halifax, Quebec, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Regina, Calgary, Edmonton, Vancouver

Represented by Powerlite Devices, Limited, Toronto **Powerlite Devices, Limited, Montreal (for Power House Sales only)**

Branches in Principal Cities Throughout the World

Electrical Indicating Instrument Authorities Since 1888

WESTON

STANDARD - The World Over

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

Volume 82 — New York, Saturday, September 1, 1923 — *Number* 9

A Notable Service to the Industry

MEN of every class in the electrical industry are agreed that the welfare and progress of the central-station companies affect them all. This is a close-knit industry with a community of interest that is conspicuously evident. There is an interdependence between the electric service company, the manufacturer, the jobber, contractor and dealer that binds them together and is freely acknowledged.

It is an encouraging thing to see how recognition of this fact is beginning to find public expression in voluntary and gratuitous support, interpretation and praise of the central station by large electrical manufacturers and others. Within recent years on several occasions extensive advertising campaigns have been diverted from the direct promotion of a product to give tribute and publicity to the quality and extent of the public service which is being rendered today by the central-station industry. This "good-will" advertising has been a strong, far-reaching influence in the upbuilding of public confidence and appreciation.

NOW comes another notable example of such creative co-operation. The Wagner Electric Corporation of St. Louis has recently produced several large folders presenting in a series of short essays or editorials, attractively illustrated, a most interesting and impressive picture of the place of the central station in modern society and its importance to the home, to business and to industry. Depicting the high order of genius and responsibility that has distinguished the men who have developed and now guide the electric power service of the country, a frank appeal is made for public support.

These folders, each copy bearing the name of the recipient printed upon it, were to the number of many thousands sent to members of the United States Senate, the House of Representatives and the Cabinet, to governors, mayors of large cities, prominent jurists, publicists, editors, state public-utility commissioners, bankers and others who influence public opinion. Moreover, toward the end of the series, went a personal letter from the president of the Wagner Electric Corporation asking for an opinion as to the comparative merits of municipal or private operation of public utilities.

THE result has been a very remarkable correspondence. Senators, congressmen, governors have written that the facts presented had given them a "broader viewpoint." Judges refrained from expressing a direct opinion, but said that they had found the folders "instructive" and were keeping them "for reference." Bankers and commissioners lauded the service that this publicity was rendering to the light and power industry by "preparing the minds of the public, who would otherwise have little knowledge." Mayors and legislators said they were "much interested." In many replies came opinions preponderantly in favor of private operation of utilities. "You are doing a splendid work for the industry" was the repeated compliment — which all electrical men will heartily indorse.

This does undoubtedly constitute a notable service to the entire industry and a striking example of the opportunity which lies at hand. For every manufacturer, jobber, contractor and dealer and every independent electrical engineer, if he will, can contribute to the advancement of the common interest in the same way, by actively and intelligently interpreting and befriending the central station, not alone by the printed but also by the spoken word.

Arthur Elmer Silver

An electrical engineer who believes in co-operative work and grasps the future possibilities in power transmission.

FORTUNATELY for the electrical industry, its engineering leaders have been broad-minded and unselfish men who believe in co-operative work to develop the industry as a whole. Notable achievements have been made by these co-operative efforts, of which an outstanding example is the work on inductive co-ordination.

Arthur Elmer Silver has taken a leading part in this work and at the same time has carried on with great success his duties as the electrical engineer for the Electric Bond & Share Company. In addition he has visioned the future and through his studies in high-voltage transmission has materially aided in the development of the art.

Born in Maine in 1879 and reared in surroundings that brought him into intimate contact with lumber-mill operation, Mr. Silver early in life developed a fondness for things mechanical and sought an engineering education at the University of Maine, where he was graduated in 1902. After completing the test course at the General Electric Company he went, in 1904, to the Raleigh (N. C.) Electric Company and rapidly rose to the position of electrical engineer and electrical superintendent in the Carolina Power & Light Company, which absorbed the Raleigh property.

The success of Mr. Silver in his work brought early recognition. In 1910 he became electrical engineer with the Electric Bond & Share Company, and he has been connected with the engineering and construction departments of this organization for the past thirteen years. In 1919 he was made consulting electrical engineer of the company. His special attention is now devoted to high-voltage transmission and substation engineering, and he has presented some notable papers on those subjects before engineering societies and in the technical press.

Aside from his duties with the organization, he has been very active in the work of the N. E. L. A. and has served as chairman of the overhead systems committee and the inductive co-ordination committee. While chairman of the inductive co-ordination committee he was largely instrumental in organizing and developing a systematic study of the inductive interference situation which paved the way for the extensive co-operative work in this field which is in progress, and he continues to be an active participant in co-ordination studies.

He participates actively in the work of the A. I. E. E. and finds time for social pleasure through his membership in the Railroad Club of New York and various clubs in Montclair, N. J., where he resides.

Editorial Comment

Electrical World, September 1, 1923

Volume 82 Number 9

A New Rate of Growth Indicated by 1923 Records

IF THE second half of 1923 shows as rapid a growth of the industry as the first half has done, some astounding figures will be recorded for the year. Reports received by the ELECTRICAL WORLD for the first six months of the present year, recorded in detail elsewhere in this issue, indicate that during this period central-station companies sold a total of 32,480,000,000 kw.-hr. of electrical energy, a gain of 25.4 per cent over the energy sold during the first six months of 1922. If this increase is maintained during the remainder of the year, the output of the central stations of the country for 1923 will total slightly over 66,000,000,000 kw.-hr., as against approximately 53,000,000,000 kw.-hr. during 1922.

The industry has become so used to playing with large growth figures that it has lost to a great degree a sensitiveness to their real value. To double the operations of an already large industry inside of four years is a stupendous undertaking, requiring foresight, steadiness of purpose and the good will of the investing public. It is safe to say that such a thing has never occurred in any primary industry of the country, unless for emergency or temporary purposes such as arise in war. The central stations and the electrical industry as a whole have a large task to perform in meeting the ever-increasing demand for energy and electrical apparatus and supplies. The industry was never in a more favorable position in the mind of the investing and consuming public. All that is required is clear thinking and a strong grasp of the problems of manufacture, generation and distribution as they come to hand.

Lighting the Streets Under Present-Day Conditions

TEN or a dozen years ago illuminating engineers were seriously and emphatically debating whether the street-lighting intensity on residence streets should be equal to that of half moon or quarter moon, or at least about those relative values. The greater use of electricity for illumination was being urged. The small unit was just beginning to make inroads into what had been admittedly the arc lamp's field. While there was some inkling of the possibility of developing a scientific illumination of the average street at relatively high intensities, and while there had been several examples of "white ways"—largely for advertising purposes, however—rash indeed would the man have been who dared to predict street-lighting practices of the kinds which are even now in a state of obsolescence.

Street lighting, or street illumination, has assumed a different character recently. In early days the principal object was to provide enough light to enable pedestrians to walk without colliding with obstructions or with other persons, and to find their homes, and to permit horse-drawn vehicles safely to navigate the more or less quiet thoroughfares and side streets. Today the problem of handling with safety the ever-increasing auto traffic, the value of high illumination as a police safety precaution, the importance of well-lighted streets in forming public opinion regarding the desirability of certain districts, together with other modern factors, all serve to focus the attention of others besides illuminating engineers and central-station men on the problem of adequate street illumination. The result has been an awakening of interest which has brought about new ideas of proper illumination intensities, which has developed new methods of installation and of design and spacing of units, and which has made city authorities study street-lighting budgets on a basis other than that of a necessary evil. True, the average American city still expends not much, if any, over half of the per capita amount which, it is estimated, should suffice to produce an adequate illumination to meet conditions in 1923. There is still much to be done to educate city authorities, and the public, as to what a proper solution of the street-lighting problem really is. Meanwhile, illuminating engineers are making substantial progress in the technique of doing the job wherever they have an opportunity to demonstrate it.

Utilities and Their Relation to Community Affairs

PUBLIC utilities have frequently been charged with having no interest in their communities beyond the money they can get out of the people. In some instances the charge has undoubtedly been true, but the usual basis for the accusation has been a lack of vision on the part of the management and a consequent failure to seize opportunities for community service that would make the charge a foolish one. Two outstanding instances of the sort of service that refutes these charges will serve to illustrate the point. Last year the individuals who had been supporting grand opera in Chicago decided that the burden had grown too heavy, and for a time it was a serious question whether opera could be longer sustained. Samuel Insull stepped into the breach, and out of his efforts has grown the Chicago Civic Opera Company. But the effort was not wholly an individual one, for not a little of the credit for its success is due to several members of the Commonwealth Edison organization who took part in the movement. An activity further from the practical every-day activities of a utility organization could hardly be imagined.

Another instance is the part taken by the Texas Power & Light Company in the effort to establish cotton mills in Texas. John W. Carpenter, the general manager of the company, has in the last few months indelibly linked both his own and the company's name with that enterprise. The reward of the company in this case

will depend entirely on the growth of population because of the efforts that have been made and on the position thus gained by the company as an institution working for the development of Texas.

These two achievements are not the only ones of the kind, but merely happen to have attracted widespread attention because of their unusual character. Many other central-station organizations are taking part in similar movements. Unfortunately there are yet a great many men in executive positions who do not discern the value of such work and who are overlooking opportunities every day to put their companies in a position that would manifest company interest in community affairs in a way that could not be misunderstood. If a community turns to the executives of its local utilities for help when important community affairs are to be handled and then realizes that a fair share of the credit for community development is due the men responsible for utility management, political attacks on the utilities of that community are not so likely to be successful. Public-spirited aid to community enterprises, regardless of whether or not they promise a direct return to the company, will refute in a way that all can appreciate the accusation of selfish indifference to civic progress.

Farm Electrical Equipment Must Be Developed

AS HAS been stated before, the secret of successful electrification of the American farm lies in the development of equipment designed for use with the electric motor and to take advantage of the economies that use of electrical energy has shown possible in other fields. Belting a standard motor to any one of the present pieces of farm equipment that can be motor-driven is no more the solution of the problem than was a similar course the solution of the problem of electrifying industrial establishments. Twenty years ago central-station men were running tests in factories to determine how the electric motor could be substituted for the steam engine. Many a long argument took place as to the relative merits of the two sources of power. In many if not most cases a motor was belted to the main-line shaft, and then the fun of finding why the calculations as to the cost of operation were not met began. Since that era there has been a tremendous development of equipment for industrial use. The electric motor and industrial equipment have been adjusted and readjusted to each other until the ensuing economies have made the question of the relative merits of the two forms of power obsolete. It has taken twenty years or more to reach the present stage of progress in the industrial field and utilize to a reasonable degree the inherent advantages of electrical energy.

The same sort of development must be gone through in the agricultural field. A glimpse of the steps that are being taken in Europe was given in an article by August Petri in the issue of the ELECTRICAL WORLD for July 21, page 123. One of the interesting things described is the general-purpose motor used in Germany that can be adapted to a number of small power uses by transfer from one machine to another. Similar motors are appearing in this country, but as yet it seems that there is too much adherence to past practice. New paths must be broken if the conditions under which equipment must be used are to be fully met and the greatest advantage of electrical energy is to be gained. A number of American manufacturers are, however, working at the problem and making progress. In fact, much electrically driven farm equipment of merit is available now, and there is reason to believe that the same development will occur in farm applications as occurred in industrial fields.

Will Artificial Lines Be as Helpful in Power Transmission as in Telephone Research?

THE facility with which any given values of resistance, inductance and capacity may be realized in the laboratory early led to the use of artificial lines for the study of all types of transmission problems. Investigations of this character have proved of enormous value in the fields of telegraphy and telephony, and it is not too much to say that the present high state of development of these arts is in large measure due to the artificial line as an instrument of research and as an auxiliary to operation. It was with the aid of artificial lines that Pupin developed his method of loading with inductance for increasing the distance of transmission, and, following him, Kennelly, and recently Hoyt and others, have developed the theory of these fictitious lumpy lines and their approximation to the smooth lines of actuality, thus indicating the importance in the communication field still attaching to this powerful instrument of progress.

As an aid to the solution of power transmission problems, however, the artificial line has not been nearly so helpful. This condition is in large measure due to the fact that in communication research the artificial line may be studied while operating under the exact conditions of practice, while in the study of power transmission problems both current and voltage are of almost infinitesimal magnitude as compared with the values pertaining to the problems under investigation. As a consequence, artificial power lines up to this time have been used principally for checking the theory of lines in their steady state, as regards progressive voltage and phase changes, standing waves and the like. The most important problems of power transmission, however, are those of the effects of transients arising in load changes, short circuits, lightning discharges, and their effects on equipment. It appears doubtful whether it will be possible to go very far in the study of these problems through the use of artificial lines, because not only are the high values of current and voltage eliminated, but it is questionable whether the ordinary circuit constants, reproduced in fixed values in the artificial line, retain their values on the actual line at the high frequencies pertaining to many types of transients.

Interesting progress in the study of transmission-line transients by means of artificial lines is shown in the papers presented by F. S. Dellenbaugh, Jr., and by V. Bush at the recent A. I. E. E. convention. The former describes a new form of construction whereby the inductance and capacity are uniformly distributed and the latter describes experiments with steep-wave pulses on both artificial and actual lines. It is probable that the oscillograms shown are the first ever obtained of the successive reflections of rectangular waves of current and voltage from the ends of open and closed lines. However, the author notes that the shapes of the wave fronts taken on his artificial line differ somewhat from those predicted by his theory, and at this point he runs into one of the important open questions of this prob-

lem, namely, as to how the normal values of resistance, inductance and capacity are affected by the high frequencies pertaining to transients. Do they remain constant, even in an artificial line, and are there even greater changes in lines carrying high values of current and voltage? Here, then, in a question of theory, there appears a most promising opportunity for the artificial line, and it is to be hoped that further results of study of this character will soon be forthcoming.

Small Steam-Plant Design Practice Changing

THE development of the stoker and the turbine greatly improved the operation and economy of small steam stations, and for several years past these stations have been pretty well standardized as regards both equipment to be used and methods of operation. But the very great activity in steam-plant design practice for large stations is now making its influence felt on the smaller stations. The paper by G. T. Shoemaker in this issue reflects the new kind of design thinking and practice that should be considered even in building small stations and thoroughly outlines the very detailed study of costs, equipment and heat-balance methods that must be made if the best possible installation is to be obtained.

Increased economy is needed in energy production, but in the present developmental stage of design an immense task confronts engineers in obtaining their objectives. It is no longer good practice to do as the other fellow did and issue a blanket specification for a station. It is now imperative that analyses be made and each station studied very carefully. Such design studies call for experienced and competent engineers well versed in thermodynamics and with a sense of economic balance. The complexity of the heat-balance analyses required is rather staggering, and no rule-of-thumb designers can attempt the task of working them out.

Some interesting departures from existing practices were made in the plant designed by Mr. Shoemaker. The use of turbine stage bleeding at three points and the use of the high-pressure bleed point to get steam for auxiliary operation may open a new field of study in auxiliary practice. Moreover, the use of the high-pressure heater to heat the feed water after it leaves the economizer is a departure in small-station design. Preheating the air for the boilers is another rather unusual practice for stations of the size considered, and many variations of the scheme used can be suggested for study.

It is interesting to note that the design considered in the paper embraces practically all known devices used in the large stations with the possible exceptions of turbine gland heaters and evaporators. The only criticism of the design that may occur will be with reference to the operation of a small plant having so many heat-saving devices. The personnel must be very carefully trained if operation is to be kept properly tuned to achieve continuously the maximum from the equipment. It would seem that station designers and station operators must both do some hard studying to grasp the newer principles of design and operation, and more studies of station designs embodying these new principles should be made available to the electrical industry.

Better Specifications for Pole Treatment Needed

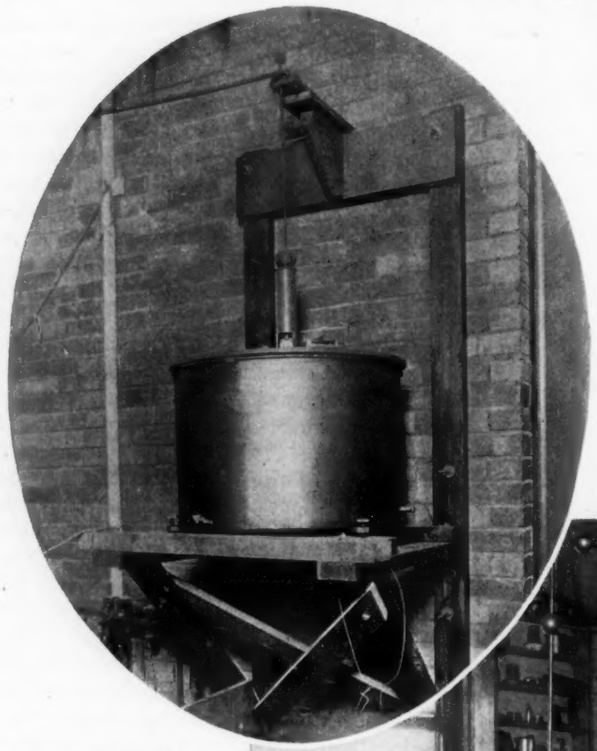
TREATMENT specifications for wooden poles have been fairly well developed so far as the preservation of wood is concerned. But there are several other factors, dealing principally with the differences in the characteristics of the wood to be handled, that apparently have not been so well covered. Western and Northern cedar and chestnut poles, having a fairly long life when set in the ground untreated, generally receive a butt treatment, the open-tank method being the one most used. To the Southern yellow pine and other types of wood which must be treated in order to be used successfully, because of the tendency of the untreated wood to decay rapidly, a complete treatment by some one of the pressure or vacuum processes is given. It is desirable in all cases that the wood to be treated shall be well seasoned.

In the case of the butt-treated poles, even with the best of seasoning, the producers cannot guarantee a complete penetration of the relatively thin sapwood because of the limitations in the available practical methods of treatment. The pine poles and any others that come under the head of completely treated poles are, in many cases, of a kind that is nearly all sapwood, the so-called heartwood, even in poles twelve inches in diameter, being in a large part of the timber available merely a small core. Penetration of the sapwood, even with the deep saturation produced by the closed-tank processes, cannot be guaranteed. In spite of the limitations placed on the treating processes many buyers insist on getting complete sapwood penetration.

In the case of the completely treated pole it is desirable that the poles be roofed, gained and bored in the producers' yards before being put into the treating tanks—something not thought of in connection with cedar or chestnut poles. Some of the telephone interests have developed a specification covering both the wood-treating and the construction processes that must be included in the pole treatment. Central-station companies using these poles have almost as many framing specifications as there are buyers. Owing to the character of some of the wood used, the time between the cutting of the poles and the setting in of rapid deterioration is relatively short, and if the poles are to be sold at all, they must be treated before that deterioration sets in. Moreover, a good job of framing is possible only when the pole is newly cut. Consequently central-station buyers sometimes find themselves in the position of having to take poles that are not framed as they wish them or of waiting until better poles can be produced. In some cases where special haste is requisite the poles may be artificially seasoned in the dry kilns, making a rather costly process. The important element in this particular situation is that there be some uniformity of specifications for the framing of poles used for definite transmission or distribution work, before treating, so that the producers can keep stock for light and power uses in reserve as is now done to some extent with poles intended for telephone lines.

Any work on the development and adoption of pole specifications that does not take into consideration these differences, and perhaps many others that must be found by investigation, will fall short of being the complete job that ought to be done. Conservation of the supply and prevention of waste ought to be one of the objects of a good set of pole specifications.

Twenty-Million-Ohm Fixed Resistance Used for Measuring X-Ray Voltage at Columbia



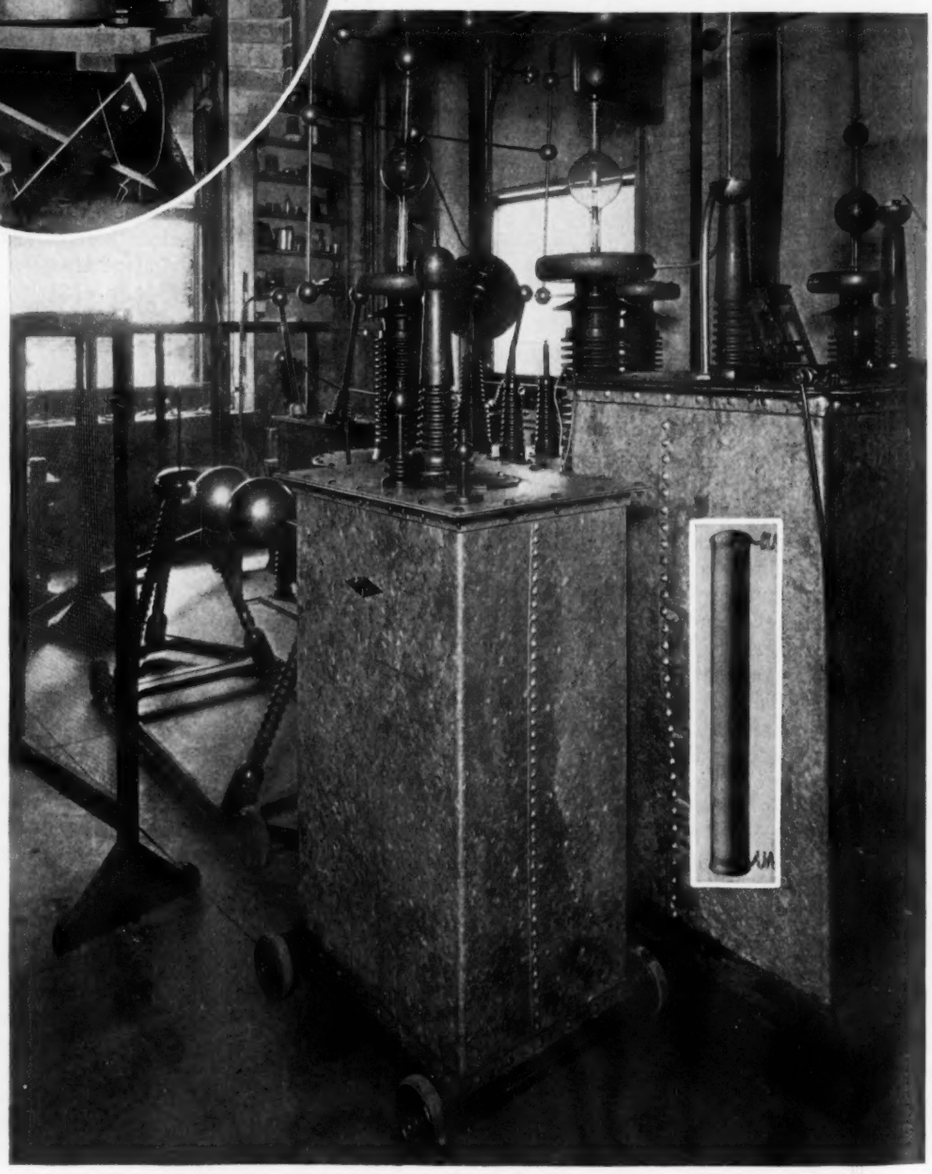
PUBLIC interest in X-ray research has been greatly stimulated of late by widely circulated newspaper reports of cancer treatment by high-voltage X-rays. At the present time important investigations along these lines are being conducted at Columbia University, New York City.

In this work, as in all other branches of X-ray research, it is highly necessary that effective means be provided for establishing as exactly as possible the potential at which the X-rays are generated. For this purpose a special 20,000,000-ohm fixed resistance, designed by Prof. Bergen Davis, professor of physics at Columbia, is employed by the university investigators to calibrate a special electrostatic voltmeter, also designed by Professor Davis.

The smaller tank, shown in the oval, incloses the 200 resistors comprising the resistance above referred to. These resistors are of the standard cylindrical "Vitrohm"-enameled "D" type (as shown herewith), each resistor consisting of a porcelain core on which the resistance wire is wound and covered with vitreous enamel which is then fused at white heat, the resistance element being thus sealed in a hard, glassy insulating envelope permanently impervious to moisture or other corroding vapors or gases.

The resistors, each of which has a capacity of 100,000 ohms, are arranged in series and mounted on Bakelite rods supported by iron brackets, the entire resistance being submerged in oil. The complete unit as shown was built to specifications drawn by Professor Davis.

The electrostatic voltmeter, also shown in the illustration, governs the motion of a beam of light from a projector, this light beam moving along a scale the calibrations of which are converted into voltage readings by use of a curve empirically constructed with the aid of the large resistance.



Causes and Prevention of Explosions in Power Transformers

Chief Hazard from Hydrogen Liberated from Oil by Arc—Must Prevent Liberation or Avoid Mixture with Oxygen to Prevent Explosion—Inert Gas Over Oil Serves the Purpose

By O. H. ESCHHOLZ*
General Manager Pittsburgh Chemical Company, Pittsburgh, Pa.

IT IS now quite common knowledge that evolved hydrogen is chiefly responsible for potential hazards residing in oil-filled apparatus.† While the history of transformer operations discloses few destructive failures from this cause, nevertheless the large investments represented in modern structures demand adequate insurance against what may have been justly considered in the past as remote contingencies.

In service transformers are subject to a number of conditions which facilitate arc formation either below or at the oil level, such as sludge‡ deposition on warm coil sections, insulation breakdown by excessive voltage or overloading, deterioration of insulation by entrapped moisture, or low oil level.

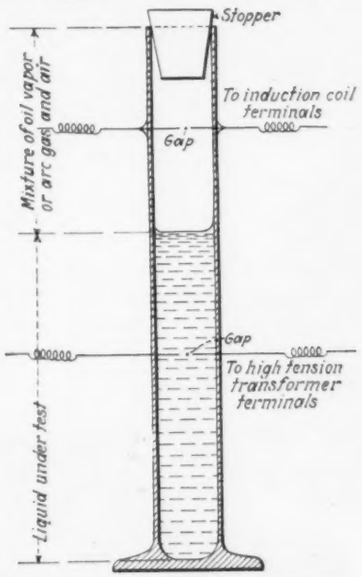


FIG. 1 — APPARATUS FOR TESTING EXPLODABILITY OF MIXTURES OF ARC GASES AND AIR OR OIL VAPORS AND AIR

Arc-Gas Constituents.—When an arc is drawn in a mineral oil the chief products of decomposition are carbon and hydrogen. Some heavier gases and vapors are produced as the result of partial cracking of oil in contact with the outer surface of the arc stream, and a small quantity of occluded gases is liberated during the heating and disintegrating processes attending arc maintenance. Below is given a representative analysis of gases evolved upon maintaining a submerged low-current, high-voltage arc in a characteristic grade of transformer oil:

Constituents	Per Cent	Constituents	Per Cent
Hydrogen	59.1	Methane	4.20
Carbon monoxide	19.21	Oxygen	1.36
Nitrogen	10.10	Carbon dioxide	1.17
Heavy hydrocarbons	4.86		

The hydrogen content depends to some extent upon the magnitude of the arc current. For short-circuit currents of the order of several thousand amperes a value of 70 per cent is more representative. Attention is directed to the fact that this analysis shows conclusively that oxygen and nitrogen are present in the oil, either dissolved or occluded, in considerable quantities and that most of the liberated oxygen combines with the arc-gas constituents. Without doubt an appreciable quantity of water was also formed as the result of the combination of hydrogen and liberated oxygen, but it was not recorded as the method of collection and analysis of arc gases gave only the permanent gas constituents.

Arc-Gas Evolution.—Assuming a relatively short arc length and an average arc-gas temperature in air space after passing through an oil head of 300 deg. C. the rate of gas formation in the common type of transformer mineral oil is of the order of 300 l. (10.6 cu.ft.) per second. Such gas evolution constitutes a hazard only when an explosive mixture is formed with "air-space" oxygen and subsequently ignited or when a sufficient hydrostatic pressure is developed in a unit completely filled with oil to cause the ejection from some weakened section of hot, inflammable gas, vapor and liquid to the atmosphere.

Explosive Limits.—The explosive limits of the major arc-gas constituents and air, as determined by numerous investigations, are as follows:

Constituents	Ratios of Gas and Air that Cause Explosion (per Cent) Lower	Upper
Hydrogen	7.9	69.4
Carbon monoxide	15.3	74.9
Methane	5.4	13.7

While these data would indicate extreme theoretical limits of 5.4 per cent and 74.9 per cent for arc-gas mixtures with air, experience has shown that in practice the range is much smaller. Observations of the performance of numerous explodable mixtures secured by heavy arcing in oil have led to the conclusion that a conservative range is 20 to 60 per cent and that the probable range for developing large pressures is from 25 to 50 per cent. This decrease in limits of explodability is attributed to the irregular diffusion of the gaseous constituents, the cooling effect of suspended liquid and the difficulty of ignition as well as the small forces developed in the region of the theoretical laboratory-established limits. The very infrequent occurrence of true explosions, despite the prevalence of conditions promoting hydrogen evolution, confirms the conclusions on a small range of explodability. In this connection, it is desired to point out that hazards caused by the development of a large hydrostatic pressure

*Formerly with material and process engineering department, Westinghouse Electric & Manufacturing Company.

†"Characteristics of Transformer Oils," O. H. Eschholz, *Electrical Journal*, February, 1919.

‡"Transformer Oil Sludge," C. J. Rodman, *A.E.S.*, October, 1921.

should not be confused with those resulting from arc-gas ignition within the structure.

Arc-Gas Ignition.—Although the existence of an arc-gas mixture in the air space should be avoided, explosive forces cannot develop unless such gases are properly ignited. In some forms of construction static or dynamic arcs in the air space are facilitated and on their occurrence ignite the gaseous mixture. However, modern power transformers are either equipped with grounded shields or with suitably disposed and proportioned leads to reduce potential gradients so that this possibility is extremely remote and the hazard exists only under the abnormal circumstance of low oil level.

Other causes leading to arc-gas ignition are deflection of arc stream into air space and transportation of incandescent particles with evolved gases into the air space. The first of these appears to be extremely rare, owing to the interference of oil head, blow-out fields and adjacent structures with arc movement.

With reference to the second cause, however, C. J. Rodman has shown that under suitably controlled laboratory conditions it is possible to ignite critical mixtures of arc gas and air in the presence of copper oxide at a temperature of 270 deg. C. However, when dealing with large gas volumes developed during internal arcing or short circuits in transformers, a temperature of at least 550 deg. C. is required in the air space if violent explosions are to be had. It is obvious that this temperature cannot be achieved during normal operation.

A gas explosion may be reproduced (Fig. 1) by first passing an arc across the lower terminals, submerged in oil, and then striking an arc across the upper terminals situated in the mixture of accumulated arc and air-space gases. It will be found that mixtures of hot oil vapor and air are not explodable in the usual sense, while mixtures of arc gases and air ignite with considerable pressure development.

Conservator Construction.—One of the first methods adopted to restrict the development of excessive pressures consisted in completely filling the transformer tank with oil. Since the volume changes in oil under the usual operating conditions are large, this method necessitates the use of an overflow or reservoir chamber to assure a completely oil-filled tank at oil temperatures. This construction eliminated the transformer "air space," reduced contact between oil and air, decreased sludging and thus very materially reduced pressure hazards.

Although the ignition of a mixture of atmospheric oxygen and arc gases within the tank was thereby positively prevented, the cushioning effect of the "air space" was lost. The need for such a space during the evolution of large volumes of arc gases under the condition of a submerged arc is obvious since no relief is provided from the rapidly increasing hydrostatic pressures in the characteristic oil-filled structure. In the perhaps unusual event of a long arc duration resulting from inadequate breaker functioning, excessive relay setting, etc., such pressures will be sufficient to eject at high velocity from a displaced gasket, ruptured seam or fractured cover a mixed stream of hot arc gases, vapor and liquid. Although the probability that this material will ignite is small, being dependent upon the volume of gases generated and the location of the failure, the advantages inherent in a cushioning space consisting of an inert gas above the oil level warranted further study of the problem of eliminating hazards.

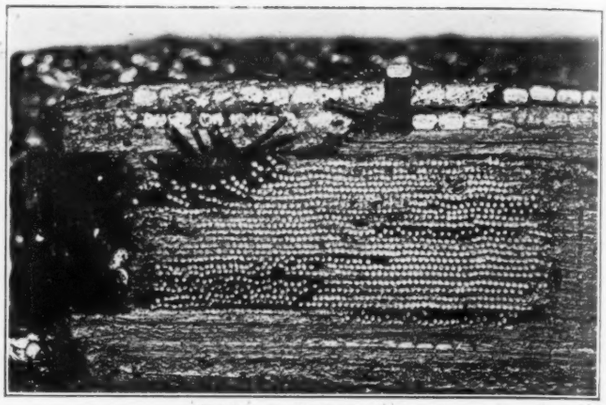


FIG. 2—SOLVENT ACTION OF "CHLORINATED" OILS ON TRANSFORMER INSULATION

Chlorinated Oils.—Such an inert cushioning space may be secured by adding to the oil a constituent of high vapor pressure that displaces the atmospheric gases with a non-inflammable vapor. The equivalent reduction in explosion hazard may also be secured by making additions which on disintegration do not form explosive mixtures with air-space gases.

A preliminary survey of the properties of known insulating liquids by the research laboratory of the Westinghouse Electric & Manufacturing Company resulted in the elimination of all but halogenated organic compounds, owing either to chemical instability, low dielectric strength or prohibitive cost. To determine the practicability of employing such liquids, the performance of transformers under operating conditions was observed with additions of hexachlorethane, carbon tetrachloride and tetrachlorethylene. It was found that greatly to reduce fire and explosion hazards approxi-

FIG. 3—SLUDGE FORMATION ON TRANSFORMER COIL IMMERSED IN A "CHLORINATED" OIL

mately 25 per cent of the halogenated compound should be added to the mineral oil and that such additions in most cases caused a rapid sludge formation and oil deterioration. While there was a marked difference in the performance of the various "chlorinated" oils, it was concluded that the utilization of non-inflammable halogenated organic additions would be impracticable as it would necessitate a radical change in insulation material and insulation distances.

Inert Gas Supply.—A more practicable means for maintaining an inert cushioning space may be secured by feeding into the "air space" various inert gases such as nitrogen or carbon dioxide. While this method is positive in character, it necessitates the development of a suitable reducing valve to permit transformer breathing without gas wastage and the admission at low pressure of the inert gas from a high-pressure supply. It was felt that the reliability of the devices considered for this purpose was not sufficient to provide the degree of protection desired.

FIG. 4—SUBSTATION DESTRUCTION CAUSED BY EXPLOSION IN AN AIR-SPACE TRANSFORMER DURING A SEVERE LIGHTNING STORM

Manhole cover was shot through roof, returning within a few inches of its original position.

Deoxidizer.—The logical development of the inert-gas-supply method is in the direction of providing means integral with the transformer tank that will generate from atmospheric gases a suitable nitrogen supply. The simplest of such means would serve to remove the oxygen from the air trapped in the cushioning space or drawn into the tank upon contraction of the oil volume.

Numerous "deoxidizing" materials may be employed for this purpose, such as phosphorus, calcium, amalgams, metallic dust, etc., the choice depending on methods required for activation, rate of combination with oxygen, control of reaction, temperature achieved, manipulation and cost.

In the commercial structure the "clean-up" material, an alkaline-earth metal alloy, functions as both a deoxidizer and a dehydrator. It is introduced into a chamber attached to the side of the tank and communicating directly to the top of the tank and also to the external atmosphere through a novel type of liquid-seal reducing value. When the internal pressure exceeds atmospheric by approximately 3 lb., owing to oil expansion, etc., excess cushioning gas is allowed to escape. When the internal pressure has fallen more than ½ lb. below atmospheric, owing to oil contraction, air is drawn into the tank through the dehydrator and deoxidizer, leaving in chemical combination with these atmospheric moisture and oxygen.

This pressure range has been so chosen that during normal operation only a slight exchange of nitrogen will occur, for the purpose of conserving the active material. The usual procedure in placing a transformer in service will consist of completely filling the tank with oil and then allowing the oil to reach its proper level with the air passing through the deoxidizer. In case the manhole cover is later removed for inspection or some other purpose and atmospheric gases are allowed to enter, the deoxygenation rate of the clean-up material may be greatly accelerated, if desired, by passing current for a few moments from a dry cell through a wire embedded in the deoxidizer. This will produce a local hot spot sustained by the energy released from the succeeding reactions until all of the oxygen shall have been removed.

Although this method of transformer protection is quite simple, its use adequately prevents sludging (by avoiding contact between air and oil), explosions (by the absence of occluded oxygen in the oil and air space) and the development of large hydrostatic pressures (by the maintenance of a suitable gas cushion). The incorporation of the "inertaire" principle in transformer construction, it is therefore felt, will practically eliminate known causes for pressure, fire and explosion hazards.

Repulsion Motors Extensively Used

THE Saxon textile industry has adopted to a considerable extent the use of special electric motors on spinning machines and this is gradually increasing. For connection to three-phase power lines repulsion motors or three-phase commutator motors are used extensively. Both types are especially adapted for use in spinning mills. They are totally inclosed and well protected against dust and damage. The smooth and simple construction of the motors enables easy cleaning and attention. Cooling air is provided through underground ducts, the circulation being produced by fans inside the motor. Where air ducts are not possible, water cooling is provided for three-phase commutator motors.

The switching on, starting and regulating of the speed is arranged by only one hand lever fixed to the motor. Speed regulating is achieved by brush shifting, i.e., without ohmic losses in regulating resistance. In the spinning-technical sense the two types of control are of equal value. They differ only in their interior power factor, phase shifting, etc., and the cost of production. Which of the two types is more adaptable in the shop depends on individual requirements.

The repulsion motor which is used most extensively may be connected to single-phase, two-phase or three-phase networks operating at voltages up to 550 without intervening transformer.

Charging Transmission Lines

Desirable Excitation Features of Generators Used on Long Transmission Lines —Analyses of Armature Reaction and Excitation Characteristics— Effect of Transformers and Synchronous Condensers

By A. W. COPLEY
General Engineer Westinghouse Electric & Manufacturing Company

IT IS well known that the armature current in an alternating-current synchronous generator reacts upon the field and, depending upon its phase relation with respect to the generated voltage, the effect may be such as to assist or to oppose the magnetic field set up by the direct current in the field winding. Lagging current flowing from the generator tends to demagnetize and leading current to magnetize it.

In charging a transmission line with no load at the receiver end the receiver voltage will be higher than at the generator end on account of the leading current flowing through the reactance of the line. Likewise, the voltage at the high side of the step-up transformers will be relatively higher than that at the generator terminals on account of the same effect of leading current flowing through the transformer reactance. Therefore, to hold the receiver voltage to normal the generator terminal voltage must be less than normal.

The adaptability of a given generator for connection to a transmission line can be more clearly indicated by the use of curves showing the terminal voltage plotted against armature current magnetization and the net line charging current plotted against generator voltage (Fig. 1).

In this curve *oa* represent the generator characteristic with zero field current. *bb'* is the generator characteristic with enough field current to give a terminal voltage of 20 per cent of normal on open circuit. *oc* and *od* are line characteristics for two different lines, that is, the charging current for given terminal voltages. If the generator with curves *oa* and *bb'* were connected to a line with the characteristic *oc* and no direct-current field were applied to the generator, it could not be self-exciting at any point. On the other hand, if a line characteristic *od* were connected to this generator, even with no field, the charging current would excite the generator and its voltage would rise until the point was reached where line *od* intersected *oa*.

Now, if some generator field is used—for instance, enough to give 20 per cent voltage at no load on open circuit—the generator would be self-exciting when connected to a line whose characteristic is *oc*, but only up to point *x*, as above this point the charging current of the line for a given voltage is less than that required to excite the generator to produce that voltage in conjunction with the applied direct-current field excitation.

The line characteristic is a straight line; that is, the charging current increases directly as the voltage except for extreme conditions when the line is considered by itself. When transformers are connected to the line at the receiving end the curve no longer is a straight line, as the magnetizing current is lagging or opposite in phase to the charging current.

In order to determine the demand for leading current on the generator, the magnetizing current of all transformers connected to the line may be subtracted from the charging-current requirement as indicated by the line characteristic. The magnetizing current of transformers connected to the receiver end becomes of considerable importance if it is possible to allow the receiver voltage to rise somewhat at no load, as the magnetizing current of transformers with overvoltage applied increases rapidly. For instance, if the magnetizing current of a transformer at normal voltage is 6 per cent, it is roughly double this, or 12 per cent, at 10 per cent overvoltage.

Effect of Transformers on Characteristics

When the transformer magnetizing current is taken into consideration, the line characteristic, therefore, departs very materially from a straight line and becomes curved (Fig. 2). A generator with characteristic *oa* connected to this line will be self-exciting up to point *x* with no field excitation, or to point *y* with field excitation, which will give 20 per cent voltage at no load. Whereas, if the transformer magnetizing current were not present, it would be self-exciting to points *x'* and *y'* respectively.

As previously suggested, the characteristics of the generator may be modified by design changes. Increasing the air gap relatively decreases the effect of the armature ampere-turns by increasing the field ampere-turns. This necessitates a heavier field construction as more field ampere-turns are connected to supply the magnetization and it tends to increase the cost of the generator. A normally designed machine—that is, one which gives most economical design and best performance, leaving out of account the charging characteristic—has the ratio of

$$\frac{\text{field current to give full voltage at no load}}{\text{field current to circulate rated current on "short"}}$$

close to unity. A machine with a short-circuit ratio of 1.5 costs approximately 15 per cent more than a normally designed machine.

The magnetizing effect of the armature ampere-turns may be counteracted by negative excitation when the generator is being operated on an unloaded line, but the difficulties in operation, due to the unstability which exists with negative excitation, are such that it is always avoided in modern stations. Regulation schemes have, however, been applied to bring the field current very close to zero without danger of reversal.

With the well-known vibrating type of generator voltage regulator, with the secondary relays energized by the exciter voltage, it is possible to operate over an exciter voltage range of only approximately one-half to full voltage. With the relays energized by a separate constant-potential source, such as a storage battery, it is possible to operate over a range from full maximum voltage to the residual voltage of the exciter with no field. This latter value is in the neighborhood of 10 per cent of the maximum value.

A regulator for such operation is known as a broad range regulator. Consideration of the curves illustrated shows that it is desirable to obtain still lower excitation than this if possible, and to meet this need an extended broad-range regulator has been developed which is a combination between a vibrating type of regulator operating to change the exciter voltage and a face-plate regulator operating to change the resistance in the generator-field circuit. The face-plate regulator comes into service only at very low exciter voltages and serves to reduce the voltage across the generator field to a value considerably below the residual voltage of the exciter.

In designing generating equipment for use on long lines of 150,000 volts and above it is essential to take into consideration the charging-current characteristics. On many lines the charging kva. of a single line is greater than the capacity of a single generator and it is out of the question so to design the generator as to take care of this condition even with zero field current. In such cases operating conditions should be adjusted so as to allow the use of a generator of normal design.

Synchronous condensers are generally used in connection with long lines to provide for voltage regulation at the receiving end. At times of heavy load the condensers are operated with strong fields so as to take leading current and hold up the voltage. Under the light-load conditions the field current is reduced so that the "condenser" takes a lagging current or, in other words, supplies charging current to the line. An automatic generator voltage regulator used on a condenser gives exactly the effect desired on the charging-current demands made by the line on the generator.

SYNCHRONOUS CONDENSERS HELP REGULATION

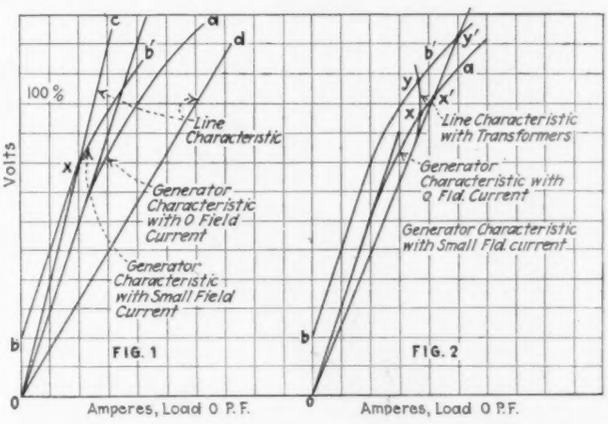
A 200-mile, 220,000-volt transmission line requires about 40,000 kva. charging current. The economical transmitting capacity of this line is in the neighborhood of 150,000 kw., and a condenser capacity of at least 75,000 kva. at the receiving end is required to obtain good voltage regulation. To use the line most economically, therefore, synchronous apparatus with a capacity of roughly 225,000 kva. is required, and it is not unreasonable to ask that operating conditions be so arranged that there will always be as much as 60,000 kva. connected at all times. The charging-current difficulty would practically disappear and normally designed generators could be used.

In the early stages of growth of any particular high-voltage system, before the load has grown, the total installed kva. may, however, be so small that it is difficult to assure 60,000 kva. in synchronous apparatus being at all times connected, and it is to tide over during this period that special attention must be paid to the generator characteristics. In some cases abnormal designs are necessary. As the generator capacity grows, it becomes easy to assure the proper amount of generating capacity being connected, and, therefore, the additional later machines added to the system can be of normal design.

The Pacific Gas & Electric Company is developing the Pit River power for use on a 220,000-volt system. There are at present installed in Pit No. 1 power house two 35,000-kva. generators which can supply 90 per cent full-load current at zero power factor leading, at 82 per cent voltage. Connected to the power-house bus are two 12,500-kva. generators, one being in Hat Creek No. 1 and one in Hat Creek No. 2 plant. Arrangement is made for stepping up from the bus voltage at Pit No. 1 power house by means of transformers to 220,000 volts, and two 200-mile circuits will then carry the power to Vaca substation, where the voltage is stepped down and two 20,000-kva. synchronous condensers are installed. These condensers can take lagging current of 12,500 kva. each. The total charging current required for the 220,000-volt lines is about 40,000 kva. per line.

Before the lines are operated at 220,000 volts, Pit No. 3 power house, with approximately 81,000 kva. in generating capacity, will be completed, so that at the Pit River end of the line there will be a total of about 175,000 kva. available in generators. It is possible to charge one line with one 35,000-kva. generator in Pit No. 1 in connection with one 20,000-kva. condenser at Vaca.

The Southern California Edison Company is bringing power from the Big Creek group of plants to Los



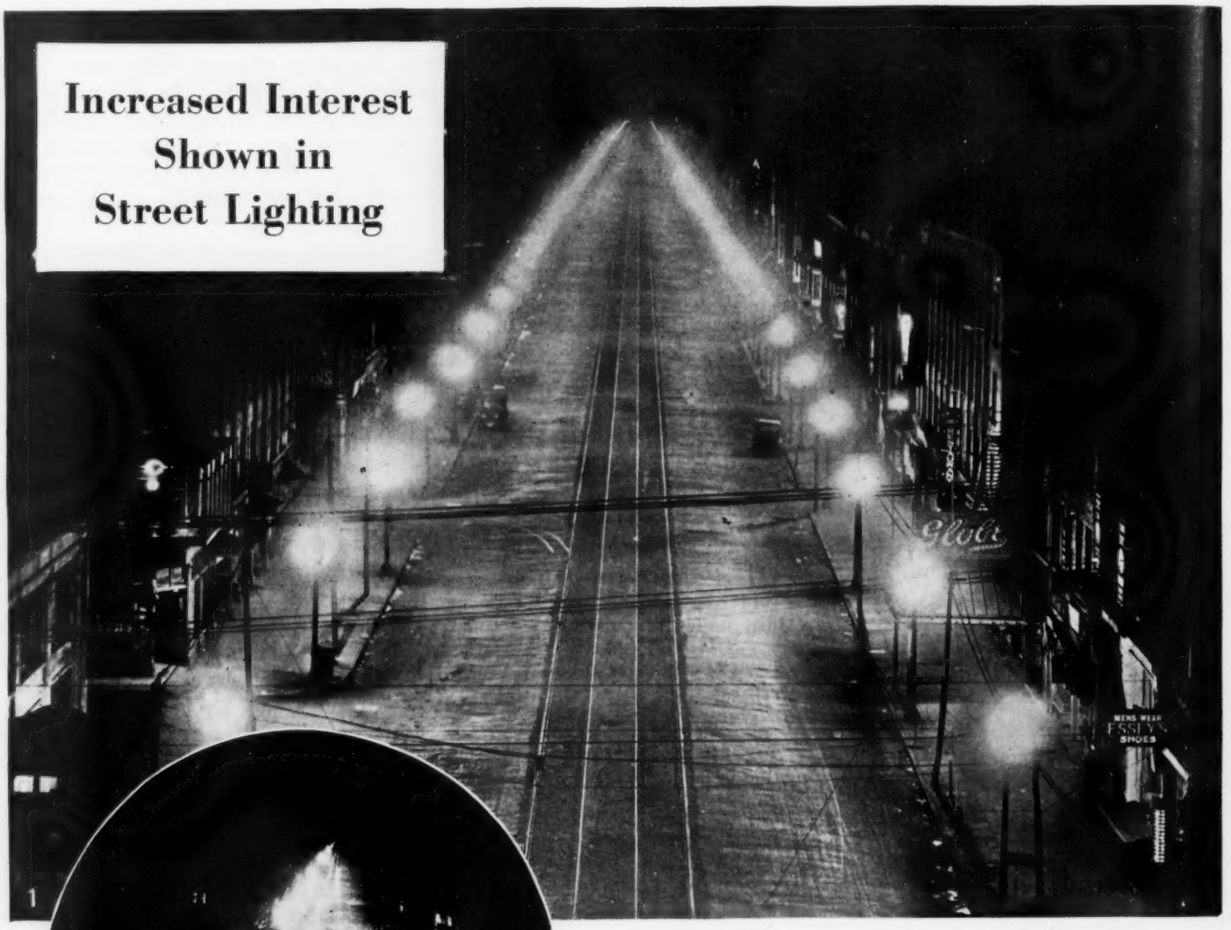
CHARGING CONDITIONS MAY PRODUCE SELF-EXCITATION IN GENERATORS

Angeles at 220,000 volts. At Big Creek No. 1 there are two 17,500-kva. generators and a third is being installed. At Big Creek No. 2 there are three 17,500-kva. generators. At each of these plants the voltage is stepped up from the bus voltage to 150,000 and then by auto-transformers is stepped up to 220,000 volts to connect to the two 275-mile transmission circuits. Big Creek No. 8, with a single 25,000-kva. generator, steps up directly to 220,000 volts, and Big Creek No. 3, now being equipped with three 28,000-kva. generators, does the same.

At Vesta substation, about 100 miles from the Big Creek plants, is a synchronous frequency-changer set of 15,000-kva. capacity. At Eagle Rock, the present terminus of the 220,000-volt line, there is 60,000 kva. in condensers. At Laguna Bell substation, which is at present being installed and which will be connected to the 220,000-volt line, there will be a 30,000 kva. condenser. This gives a total capacity in synchronous apparatus on the system of approximately 320,000 kva. About 50,000 kva. is required for charging each of the two existing circuits from the Big Creek plants to Eagle Rock, and the extension to Laguna Bell will bring this up to approximately 60,000 kva. each.

Therefore, both in the case of the Pacific Gas & Electric Company and that of the Southern California Edison Company, the margin of available capacity over the charging-current requirements is considered sufficient so that future generators can be applied without altering the design from normal for the purpose of increasing the charging-current characteristics.

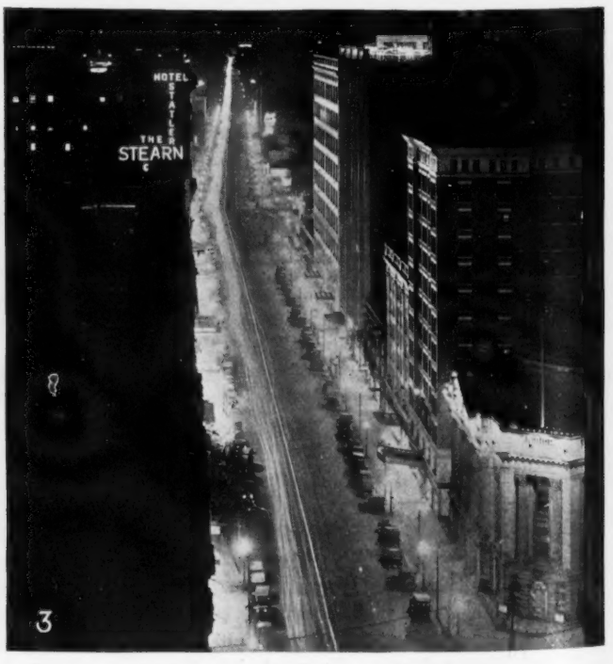
Increased Interest Shown in Street Lighting



Nos. 1 and 1A.—Cleveland, Ohio. Old and new lighting on Woodland Avenue. The new system consists of 1,000-cp. "Mazda" C" lamps in General Electric "Novalux" lanterns. Spacing, 100 ft.; lamp mounting height, 15 ft.

No. 2.—East Cleveland, Ohio. Population, 28,000. 1,600-cp. "Mazda C" lamps in General Electric bracket-style "Novalux" refractor fixtures. Length of bracket arm, 6 ft.; staggered spacing, one lamp per 140 ft. of street; mounting height, 20 ft.

No. 3.—Cleveland, Ohio. Population, 900,000. Euclid Avenue: 1,500-cp. "Mazda C" lamps in General Electric "Novalux" lanterns. Spacing, 85 ft.; mounting height, 15 ft.



THE present unprecedented activity in street lighting—a natural result of the logical policy of postponement adopted by municipalities during the period of inflated costs—clearly reflects the general acceptance by those interested in civic betterment of four basic facts:

1. That the safety and convenience of modern high-speed traffic dictates a standard of illumination substantially superior to that which met the needs of horse-drawn vehicles.

2. That effective street illumination at night is wholly compatible with a pleasing daytime appearance of the lighting system.

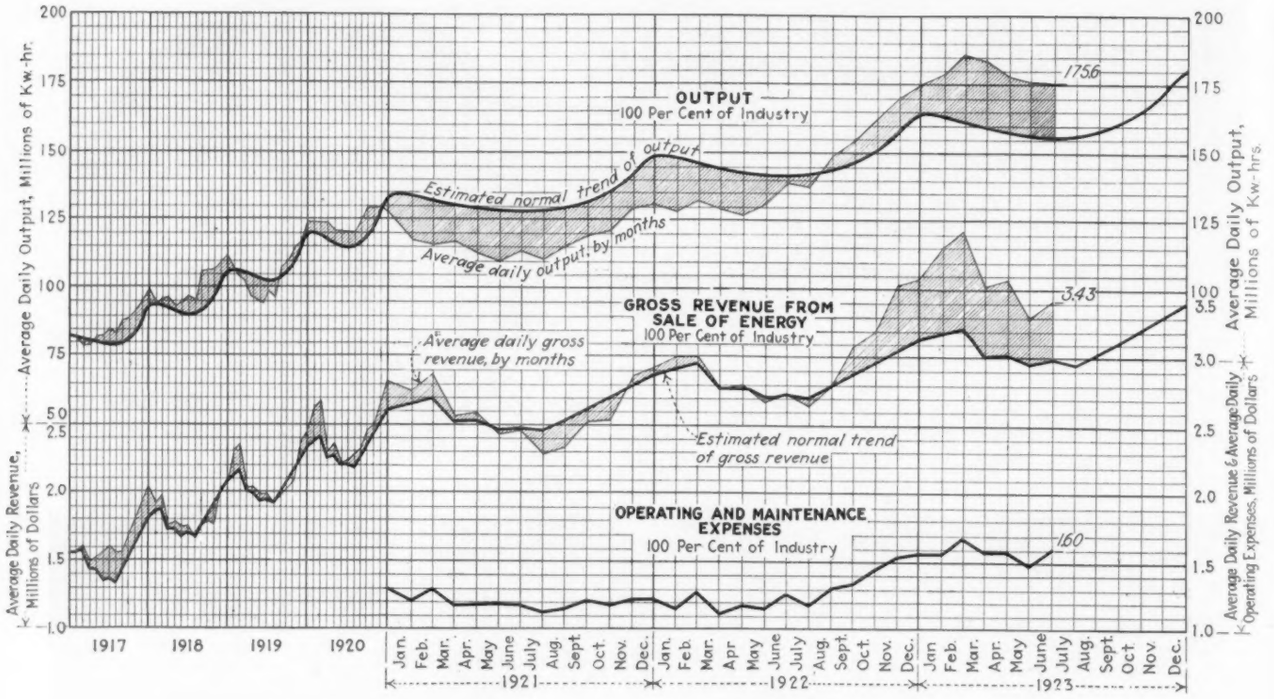
3. That the design of a street-lighting installation is an engineering problem requiring the services of an experienced illuminating engineer.

4. That the town of a few hundred inhabitants has relatively as much to gain from adequate street lighting as the city of several hundred thousand population.

No. 4.—Toledo, Ohio. Population, 245,000. 300-watt (approximately 500-cp.) "Mazda C" lamps in rippled globes; refractor fixtures, two per pole. Spacing, 100 ft.

No. 5.—Fremont, Ohio. Population, 13,000. "White way" lighting; 600-cp. "Mazda C" lamps in General Electric "Novalux" units. Spacing, 85 ft.; mounting height, 13½ ft.

No. 6.—Sebring, Ohio. Population, 3,600, 600-cp. "Mazda C" lamps in General Electric "Novalux" fixtures. Spacing, 90 ft.; mounting height, 13½ ft.



THE CENTRAL-STATION OUTPUT DURING JUNE WAS 10.9 PER CENT ABOVE NORMAL AND THE GROSS REVENUE WAS 14.7 PER CENT ABOVE NORMAL

Six Months' Output Shows Gain of 25.4 per Cent Over 1922

REPORTS received by the ELECTRICAL WORLD for the first six months of the present year from central generating and distributing companies representing 75 per cent of the installed generator rating of the country indicate that the energy sold by the electric light and power industry during this period totaled 32,480,000,000 kw.-hr., a gain of 25.4 per cent over the energy sold during the first six months of 1922. If this increase is maintained during the remainder of the year, the output of the central stations of the country for 1923 will total slightly more than sixty-six billion kilowatt-hours. The largest output for any month during the first half of the present year was that reported for March, with 5,720,000,000 kw.-hr.

The reports on revenue from the sale of energy for the first six months of the year are also most interesting. The revenue of the industry for this period totaled $649,300,000, as against $542,900,000 for the first six months of 1922, or a gain of 19.5 per cent. If this increase is maintained during the remainder of the year, the revenue of the central stations of the country for 1923 will total very close to $1,300,000,000. The record figure for revenue for the six-month period was that reported during January, showing a total of $117,400,000.

The total operating and maintenance expenses for the first six months of the year, exclusive of interest, taxes, depreciation or sinking fund, totaled $286,170,000, an increase of 21.0 per cent over a similar period for 1922. If this rate of growth is maintained for the remainder of the year, the operating expenses for 1923 will total very close to $600,000,000.

Reports for the month of June indicate that the average daily output totaled 175,593,000 kw.-hr., which is slightly below the output reported for May. A study of the accompanying diagram indicates that the central-station output during June was about 10.9 per cent above what would have been the seasonal energy requirements if the industry had been normal. The average daily revenue from sale of energy during June was $3,426,000, which was slightly above the revenue reported for May. This is 14.7 per cent above what would have been the revenue if growth in the industry had been normal. The revenue reported for January of this year was 13.7 per cent above the estimated normal revenue for that month.

The "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" which appeared in the Aug. 18, 1923, issue of the ELECTRICAL WORLD indicated that during June the electrical industry as a whole was operating at 11.5 per cent above the point of normal demand. It would appear, therefore, from the above figures that activity in the electric light and power branch of the industry during June was slightly below that of the electrical industry as a whole in so far as sale of energy was concerned, although the abnormal revenue would tend to reverse that statement.

CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
April..	73	3,894,871	3,072,907	26.8	68	$73,485	$60,990	20.5
May..	74	4,038,622	3,301,715	22.3	69	70,660	58,922	20.0
June..	75	3,950,920	3,300,189	19.7	69	70,934	59,883	18.5

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined Systems of Steam and Hydro 1922
April..	56	26,347	21,274	23.9	48.2	49.0	30.8	28.8	44.7	42.0
May..	57	26,322	21,906	20.2	51.3	52.5	29.4	25.6	44.2	43.5
June..	58	27,848	23,653	17.7	50.2	54.2	28.0	26.4	43.7	44.9

Producing Synthetic Gray Iron in the Electric Furnace

Experiments by Hartford Electric Light Company Indicate Commercial Possibilities for Use of Excess Off-Peak Hydro-Electric Energy—Iron Foundry Industry Offers New Field for Electric Furnace Application

By EDWIN L. WILLSON
Consulting Engineer and Metallurgist, Hartford, Conn.

IN THE fall of 1922 the unusually large differential in price between pig iron and steel scrap at New England points presented an opportunity for making an experimental run of synthetic gray iron. The Hartford Electric Light Company was interested in obtaining cost and metallurgical data on the process, and as the plant of the Connecticut Electric Steel Company, containing two 2-ton Heroult steel furnaces, was available, the experiment was begun on Nov. 16, 1922, under the supervision of the writer.

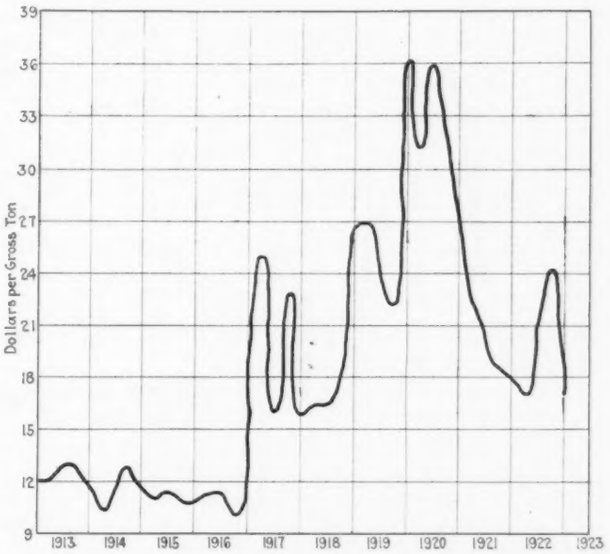
As regards costs there were two objects, the first being to determine the commercial possibilities for a central station to produce synthetic pig iron from steel scrap, utilizing off-peak power at a price to compete with the blast-furnace product used by iron foundries. The second object was to determine the relative cost and metallurgical characteristics of synthetic gray iron made direct into castings as compared with those produced in iron foundries by the cupola process.

Economic Factors in Problem

The economic factors which govern the possibilities of synthetic iron are the relative costs of pig iron delivered in a given district and the net value of steel and iron scrap produced in that district—in other words, localities sufficiently removed from the large steel and iron districts for the freight cost on pig iron purchased from and scrap sold for shipment to the steel centers to be considerable. The price differential between No. 2X foundry pig iron and steel scrap at Hartford is shown graphically in the accompanying illustration.

The term "synthetic iron" has been applied to gray iron which is produced by raising the carbon content of steel by the addition of a carbonizing agent such as coke or charcoal to a point approximating 3½ to 4 per cent, which is the average carbon content of blast-furnace iron. The term has been extensively used in articles on this subject, but is slightly misleading, as it implies the use of chemical reactions to produce a complex chemical compound from elementary substances. The term is applicable as regards the elements iron and carbon while the metal is in the molten condition, but the analogy is less apparent after solidification, when gray iron becomes in reality an admixture of an alloy steel with graphite. The raw material used in these experiments was principally basic open-hearth steel scrap of about 0.20 per cent carbon. Large tonnages of this material are available in New England as a byproduct from the many industries in which duplicate parts are produced by stamping from cold-rolled strip steel.

The process used was similar to melting steel scrap for steel castings, the cold charge being first melted



PRICE DIFFERENTIAL BETWEEN NO. 2X PIG IRON AND STEEL SCRAP, 1913-1923

as in making a steel heat. The carbonizing agent was then added to the surface of the bath and the latter thoroughly agitated until the required amount of carbon had been absorbed. The desired percentages of silicon, manganese and phosphorus were obtained by the addition of these elements in the form of their ferro alloys.

Energy Consumption by Acid Method

The test was started with the furnace lined with acid refractories, and a total of 111 heats was made by the acid process, 505,446 lb. of material being charged with a power consumption of 148,386 kw.-hr., which includes energy necessary to burn in the bottom and may be summarized as follows:

	Kw.-hr.
Initial power	148,386
Add power used for other purposes (cranes, air compressor, etc.)	12,796
Total power consumed	161,182
Deduct power not used for melting	17,396
Power used for melting only	143,786
Power consumed per gross ton charged	714.3
Power consumed per gross ton charged (melting only)	637.4

This is a simple melting operation, as the acid slab does not permit of refining reactions to reduce the impurities, the resultant percentages of such impurities being the accumulated amounts present in the material charged. The analysis taken of typical heats of the various grades of iron produced is given in Table I.

TABLE I—RECORD OF CHEMICAL ANALYSIS, ACID PROCESS

Heat No.	Total Carbon	Si.	Man.	P.	S.
1	2.27	2.67	0.77	0.03	0.048
2	2.122	.....	.....	.....	.....
3	3.04	2.55	1.04	.....	.....
4	3.438	3.05	.....	.....	.....
5	3.252	3.39	0.99	0.056	0.056
6	3.434	2.43	1.00	0.035	0.067
7	.....	3.02	.....	0.475	0.074
8	.....	1.74	0.93	.....	0.056
9	2.976	2.02	1.02	0.596	.....
12	2.584	2.44	1.16	0.673	0.045
13	2.824	3.30	.....	.....	0.045
17	2.366	.....	1.15	.....	.....
18	3.142	.....	.....	.....	.....
19	3.212	.....	.....	.....	0.048
20	3.320	2.57	1.05	.....	.....
23	3.266	2.78	.....	.....	.....
28	2.460	2.23	.....	.....	0.065
43	3.182	1.57	.....	.....	.....
44	3.092	2.46	.....	.....	.....
52	2.688	2.44	0.74	0.375	0.058
59	.....	3.10	0.97	.....	0.067
66	2.388	2.46	0.81	0.578	0.080
70	2.85	1.55	0.99	0.042	0.071
76	Transverse test bar broke at 6,200 lb.				
80	3.650	2.08	.....	.....	.....
82	3.180	2.05	.....	.....	.....
83	3.44	2.23	0.80	0.064	0.062
87	.....	2.27	0.88	.....	0.056
94	2.444	2.04	.....	.....	0.044
99	3.026	2.92	.....	.....	0.021
102	3.214	2.55	0.84	.....	0.054
105	3.536	2.32	.....	.....	.....

The experience gained by this run of the acid process leads to the following conclusions:

1. If scrap of high quality as regards analysis is available, together with low sulphur coke, gray iron of excellent quality may be produced by the acid process.

2. If the iron is to be poured direct into castings, it may be produced on an acid hearth with medium sulphur coke, and the sulphur content of the resulting castings will be lower than the average run of cupola iron.

3. The acid process is not sufficiently flexible for the production of synthetic iron in the form of pigs for remelting in the cupola on account of the danger of running too high in sulphur.

4. The control of carbon, silicon and manganese can be held within close limits, and iron with practically any percentage of these elements may be made at will.

5. For the production of foundry iron for remelting in the cupola requiring phosphorous content of 0.40 per cent or higher for fluidity, the cost of adding ferrophosphorus is too high to make the addition commercially practicable.

6. It was demonstrated that very small intricate castings of thin section could be poured from the electric furnace with synthetic iron in which the phosphorous content did not exceed 0.03 per cent. These castings were free from chill effect and their machining qualities in all respects were equal to cupola castings. The very much lower phosphorous content resulted in increased strength and resistance to shock as compared with cupola melted iron.

TABLE II—RECORD OF CHEMICAL ANALYSIS, BASIC PROCESS

Heat No.	Total Carbon	Si	Man.	P.	S.
113	3.172	1.24	0.77	0.050	0.021
115	.....	3.15	0.77	0.68	*0.035
123	3.368	2.67	0.74	0.611	0.017
124	.....	3.44	0.70	0.038	*0.042
125	3.284	3.49	0.69	0.060	0.011
137	.....	1.03	.....	.....	0.019
145	2.868	2.67	0.77	0.578	0.025
149-152	.....	1.82	0.83	0.043	0.041
154	1.768	11.23	0.71	0.029	0.014

* Sulphur determined by evolution. A check on heat 124 by the gravimetric method showed sulphur 0.011.

Results by Basic Method

In order to determine the possibilities of refining reactions, the furnace was relined with a basic hearth and forty-five heats were made by the basic process, 209,213 lb. of material being charged with a power consumption of 68,840 kw.-hr., including burning in bottom, which may be summarized as follows:

	Kw.-hr
Initial power	68,840
Add power used for other purposes (cranes, air compressor, etc.)	3,978
Total power consumed	72,818
Deduct power not used for melting	16,738
Power used for melting only	56,080
Power consumed per gross ton charged	780
Power consumed per gross ton charged (melting only)	600.4

The operation was carried on in the same way as with the acid method with the exception that the heat was held under a desulphurizing slag for varying periods to determine the possibilities of sulphur reduction. Typical analyses of the various grades of iron produced on the basic hearth are given in Table II.

The result of this experience with the basic process leads to the following conclusions:

1. On account of its superior refining possibilities it allows greater flexibility in the selection of raw materials, especially as regards sulphur content.

2. The control of the alloy constituents may be held to limits as close as those with the acid process.

3. The absorption of carbon is accomplished more readily than in the acid process.

4. The refractory cost is slightly higher per ton, which is more than offset by the lower power consumption and cost of raw materials.

In general the result of this test with both the acid and basic methods leads to the following conclusions:

1. In order for the production of synthetic pig iron for sale to iron foundries to be possible commercially, the differential between the delivered price of pig iron and the sale value of steel scrap must be greater than the normal spread found in New England. This condition exists in the Middle and Far West, where the freight on pig iron is high and that on scrap prevents its return to the steel-making districts. The process offers commercial possibilities for central stations having excess off-peak water power so situated that suitable steel scrap is available and in reach of a market for pig iron. The process is adaptable for this purpose in that it is not necessarily continuous, but may be operated to accommodate the periods of low load.

2. Synthetic gray iron may be produced in the electric furnace under favorable conditions at a price equal to or lower than that of the better grades of cupola iron.

3. The production of synthetic gray iron for castings offers a field for utilization of off-peak power in cases where the foundry operation can be rearranged so that the molds may be poured off at night.

4. Synthetic gray iron produces castings having physical strength and toughness far in excess of the best cupola iron, and its chemical analysis shows possible reduction of impurities far below the limitations of the cupola.

5. Reports from foundries which used the pig iron produced in this run indicate that the superior quality

of synthetic iron is largely lost when the iron is remelted in the cupola.

6. The use of the electric furnace for the production of synthetic iron offers a broad field for further development of irons of composition varying from the accepted standards which have been developed for the cupola product. The various percentages of carbon, silicon, manganese, sulphur and phosporus which have become standard practice in iron foundries are a compromise between the results desired and the limitations of the melting medium to produce these results. The electric furnace not being subject to the limitations of the cupola in that its atmosphere is reducing rather than oxidizing, the charge is not contaminated by contact with fuel and flux, and, being free from the relatively low limit of temperature, the furnace offers a melting medium of much greater flexibility than the cupola. The last few years have seen considerable interest in the possibilities of the electric furnace for the iron foundry as shown by the discussions before the technical societies, and it has been predicted that the electric furnace will soon occupy a field of importance in the iron foundry industry equal to, or greater than, its present position in the steel foundry.

The process of refining of molten iron delivered from the cupola, known as duplexing, has been rather thoroughly discussed and is being carried out to an increasing extent commercially. Although this process will, no doubt, develop rapidly owing to its aid in the solution of the sulphur problem, it would seem that the so-called synthetic-iron process also has a certain field of application.

Points in Modern Power-Plant Design*

Possibilities Which Inhere in Bleeding Steam from Turbines for Auxiliaries — Consideration of Economizers — Influence Exercised by Fuel Supply on the Selection of Equipment

B. G. T. SHOEMAKER
United Light & Railways Company, Grand Rapids, Mich.

THE problems now confronting the designing engineer are somewhat different from those of a few years ago. We used to use a great number of small steam-driven auxiliaries on the assumption that the exhaust steam would be utilized for heating the feed water, and consequently high steam consumption per horsepower was of little moment. With this type of design there was often a considerable waste of steam because of the plant's inability to absorb it.

The object now is to get as much work out of the steam as possible and at the same time obtain all necessary heat for heating the water. The tendency is decidedly toward the use of electrically driven auxiliaries with suitable provisions for emergency. When using motor-driven auxiliaries it is necessary to procure the heat from sources which are more economical than the old ones.

Bleeding Steam for Auxiliaries

Present-day turbines are of such design that steam may be extracted from the different stages. It is possible to extract a sufficient amount for heat-balance requirements after the steam has been utilized for the most economical production of electricity. By extraction at different stages it is possible to get steam at different pressures to take care of the heating best adapted for that pressure. It is best to bleed the steam at the lowest possible stage, as a greater amount of work is obtained and the full latent heat is left for heat-balance purposes. Another thing to avoid in using a bleeder system is an unnecessary loss by giving up the heat in the exhaust steam to the circulating water, after which it cannot be recovered. As an actual example, a turbine under straight condensing operation would pass 195,000 lb. of steam to the condenser. The same turbine under the same load conditions but with bleeding, for which the plant is designed, would pass only 170,412 lb. of steam to the condenser. The latent heat of 24,588 lb. of steam per hour is lost under straight condensing operation, but by bleeding it is possible to conserve this amount of heat, minus some minor losses, by taking the steam out of the turbine before it reaches the condenser. The steam expands adiabatically to 0.5 absolute or 28.9 in. vacuum. The temperature would be 79.7 deg. F. In this particular case the steam quality would probably be 0.80. The latent heat per pound of steam would be 1045.9 B.t.u., or, in other words the total B.t.u. saved would be $1,045.9 \times 24,588 \times 0.80 = 20,550,000$ B.t.u. Allowing for the efficiency of combustion, assume that 7,720 B.t.u. is obtained from a pound of coal, or the total pounds of coal saved per hour $= 20,550,000 \div 7,720 = 2,660$ lb. per hour. For eighteen hours per day 300 days per year, with coal at $3.50 per ton, the total saving would be $2,660 \times 18 \times 300 \times 350 \div 2,000 = \$25,137$. This will certainly justify from $20,000 to $30,000 additional expenditure for equipment.

Method of Handling

In working up the heat diagram for any particular installation it is necessary to make certain assumptions and figure the diagram. It is usually necessary to make calculations for at least four different load conditions. To illustrate how these matters are handled, Fig. 1 gives an illustration of an actual problem which is figured on the basis of a 20,000-kw. load. The illustration shows how the steam is fed to the system and the different bleeding points. How it is utilized in the various pieces of equipment is also shown. The boilers supply a total of 225,378 lb. of steam per hour. This

*Paper presented before the Iowa Section, N. E. L. A., convention held at Mason City, Iowa, June 26-29, 1923.

steam will all enter the turbine. At a point below the impulse stage is a connection where it is possible to bleed steam at a pressure range from 70 lb. to 190 lb. and 180 deg. superheat. The impulse blading has really acted as a reducing valve and has availed itself of the useful energy in the steam from the maximum pressure and temperature down to this point. It is proposed to use this steam for some of the steam auxiliaries, avoiding auxiliary piping at high pressure and high superheat. The steam from this high-pressure stage will also be used for heating water at the higher temperatures. The second stage will supply steam under those load conditions at 59½ lb. absolute with 91 deg. superheat. This steam will be used for equipment requiring lower pressures and temperatures. There are also stages for extraction at 14.57 lb. and 3.442 lb. absolute.

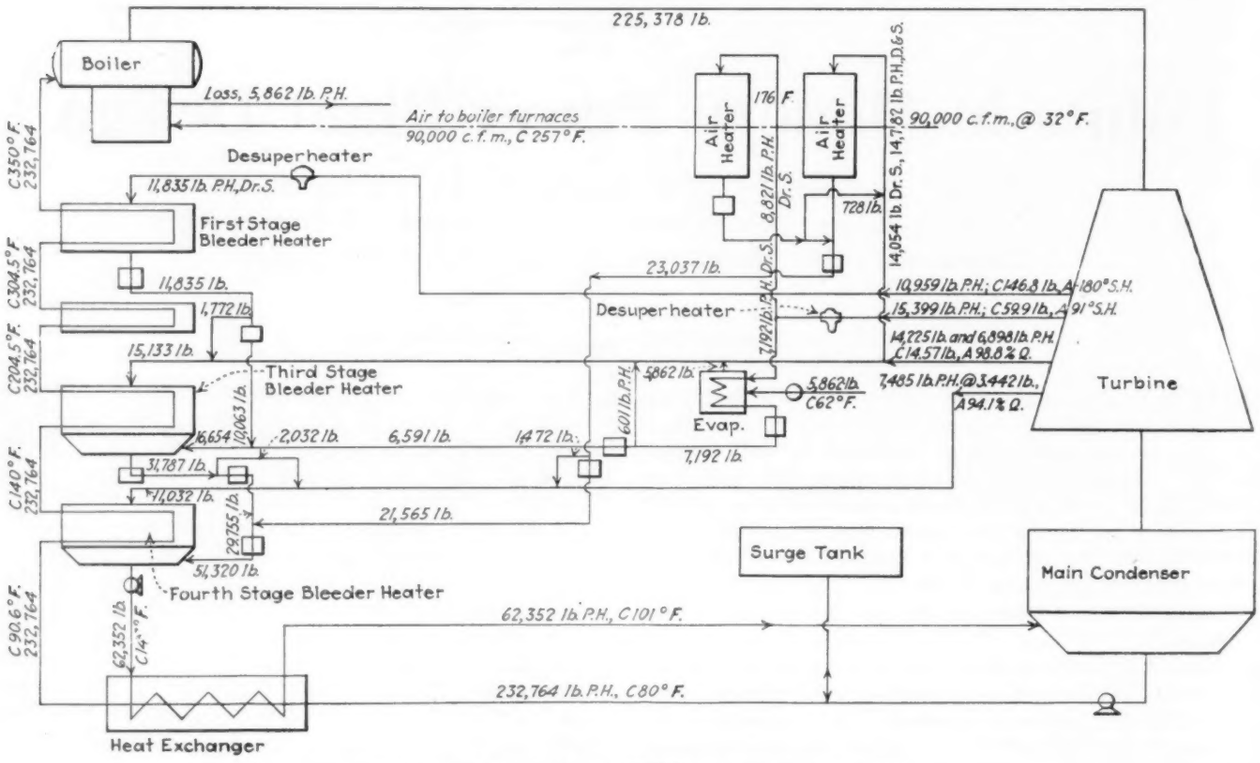


FIG. 1—HEAT DIAGRAM FOR 20,000-KW. PEAK-LOAD PLANT

Showing the amount and disposition of steam bled from various turbine stages and the amount of steam supplied to the turbines.

The object is to bleed the maximum amount of steam that can be used from the lower stages. In this way a greater number of kilowatts can be produced from the steam and at the same time the full benefits of the heat effect can be virtually assured. In this system there are three sets of heaters, two of which are low-pressure and the other high-pressure. According to estimates, there will be a total pumpage of 232,764 lb. of condensate per hour at 80 deg. F. This pumpage is materially increased by a certain amount of recirculation, brought about by putting the condensate from the heating system back into the condenser hot well to flash it and remove any air that might be entrained during the cycle.

Starting with the low-pressure heater, it will be observed that the temperature of the water is increased from 90.6 F. to a temperature of 140 deg. F. The third-stage heater increases the temperature from 140 deg. to 204 deg. F., owing to the higher pressure and the corresponding higher temperature of the steam supplying the heater. At this point the water passes through the economizer and is increased to a temperature of 304.5 deg. F. In the past it has been considered sufficient to stop at this point. It is desirable to reuse as much of the steam as possible to avoid giving the heat up to the circulating water and thereby losing it entirely. In this installation a high-pressure heater will be used supplied with steam from the first-stage bleeder. By doing this the temperature will be raised from 304.5 deg. to 350 deg. F., at which temperature the water will enter the boiler.

Engineers have realized for a long time that they could make a material saving if they could preheat the air to the boilers. This has been tried a number of times by having air heaters installed to absorb heat from the stack gases, as well as by using warm air generators. Either of the methods has its drawbacks as there are complications, especially when using the stack gases, from the extra drop in pressure and the difficulty in keeping the heaters cleaned for a proper heat transfer through the tubes. There is an excess capacity for bleeder steam, and it is proposed to heat the air after it leaves the forced-draft fans before entering the main duct to the stokers. It is estimated that it will require 1,405 lb. of steam to heat 90,000 cu.ft. of air per minute at a temperature of 32 deg. F. and a resultant temperature of 257 deg. The change in temperature of the air should make a great improvement in combustion conditions. The only difficulty that may be encountered is the possibility of increasing the operating temperature of the stokers to a dangerous point.

It will be of interest to study the possibilities of

capacity for bleeding steam and the effect on the total water rate for the turbine. In Fig. 2 curve 1 shows the water rate of the turbine operating straight condensing; curve 2 shows the water rate of the turbine when operating at the maximum bleed, and curve 3 the approximate water rate of the turbine under the conditions planned in this particular installation.

It will be observed by the difference between curves 2 and 3 that all of the possibilities for bleeding steam have not been absorbed. However, as much steam as possible has been used for various requirements around the plant.

Another interesting subject is the relative economies of small turbines, say of 2,000-kw. and 3,000-kw. capacity, and the larger units, say of 20,000-kw. capacity. The curves shown in Fig. 3 are taken from actual data on turbines installed or being installed in different plants. Curve *A* is the water rate for a 20,000-kw. turbine. Curve *B* shows the rate of a 3,000-kw. high-economy unit now on order. Curve *C* shows the economy of a 2,000-kw. turbine installed in 1918. At that time, for a unit of this size, a water rate of 14.1 lb. was considered real efficiency. With the 3,000-kw. unit, which is a fifteen-stage machine, there will be a saving of 4.4 lb. per kilowatt. We could not afford to operate the 2,000-kw. unit at any load within the range of either turbine, provided that the 3,000-kw. unit was in condition for service. To illustrate the possibilities with these small machines, the curves have been plotted as a comparison with that for a 20,000-kw. unit, now on order. This curve is based on a 350-lb. pressure and a total temperature of 636 deg. Since plotting this curve it has been decided to use 400 lb. at the throttle, which would improve its water rate. The large machine at its best point is only 2.1 lb. better than the 3,000-kw. unit at its best point. The 3,000-kw. unit, however, is 4.4 lb. more efficient than the 2,000-kw. unit of the earlier design. The smaller machine economies are based on 225 lb. and 125 deg. superheat. This illustrates plainly the strides being made in some of the smaller designs and shows the possibilities in superseding older equipment with installations of high-economy units.

Another item in the design of a new plant is the proper protection and installation of boilers and other combustion equipment. It is necessary to study the character of the fuel supply as this is the factor determining how boilers will be set and the type of stokers to be used. Under present conditions coal of various grades is likely to be received. Some stokers will perform satisfactorily under certain conditions, but when the coal of this certain quality is not available extreme difficulty is encountered in carrying load. It is quite essential that a stoker be proportioned to burn coal efficiently at both low and high rates of combustion.

Steam requirements and average load conditions must be analyzed. It is then time to determine the number of boilers required for the supply of steam, keeping in mind that as the usual thing it is necessary to have one spare unit available for repairs and maintenance. With the decision as to size of the boiler, the economizer should be kept in mind. It is really a part of the boiler, and if used, the size of the boiler should be cut down in proportion to the capacity of the economizer. In many plants it has been the practice to put in boilers of full capacity and then add the economizer. This means an unnecessary investment and in many cases, if properly capitalized, would not show the economizer to be economical. If recognition is given the equivalent boiler

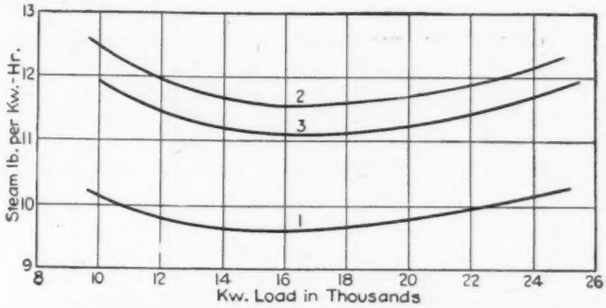


FIG. 2—EFFECT OF BLEEDING STEAM FROM 20,000-KW. TURBINE IN COMPARISON WITH THE STRAIGHT CONDENSING WATER RATE

Condition, 350-lb. gage, 250 deg. superheat, 29 in. vacuum. No. 1—Water rate, condensing. No. 2—Water rate, maximum bleeding. No. 3—Water rate, actual bleeding.

capacity provided by the economizer, investment in the boiler can be cut materially. This saving in boiler investment should be credited toward the investment in the economizer.

Fig. 4 shows some data plotted in connection with recent purchases. On the horizontal lines is plotted the steam generation in thousands of pounds per hour and on the vertical lines horsepower. Curve A shows the horsepower developed by the economizer under various ratings. Curve B shows the equivalent horsepower developed by the superheater. Curve C shows the horsepower developed by the boiler, curve D by the boiler and the superheater, and curve E is another combination, showing the horsepower developed by the boiler, superheater and economizer. This shows the relations between the three units, all of which should have careful consideration in selecting equipment.

Fig. 5 shows a study of temperatures. The first vital interest is the temperature of the gases leaving the boiler. Always strive for designs which will extract the maximum amount of heat from the gases by the time they reach the outlet of the boiler after going through the boiler and the superheater. The economizer is designed to absorb efficiently from gases heat which otherwise would be lost. There is a curve show-

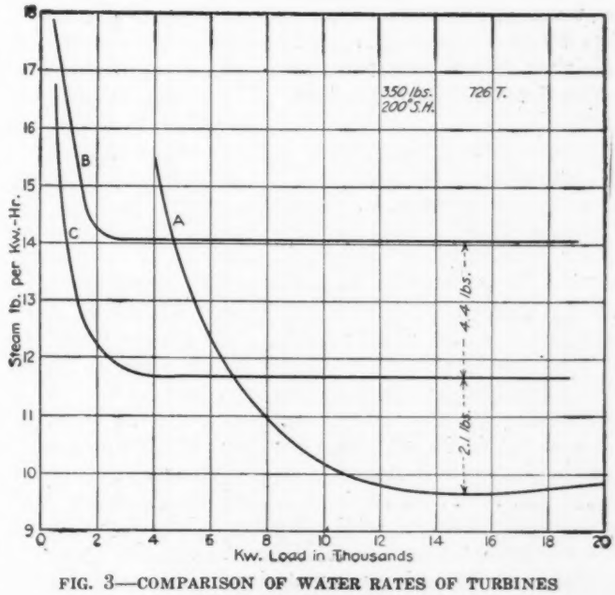


FIG. 3—COMPARISON OF WATER RATES OF TURBINES OF VARIOUS SIZES

Curve A is for a 20,000-kw. turbine operating at 350 lb. pressure, 725 deg. total temperature, 200 deg. superheat and 29 in. vacuum. Curve B is for a 3,000-kw. machine of recent manufacture and curve C for a 2,000-kw. machine installed in 1918.

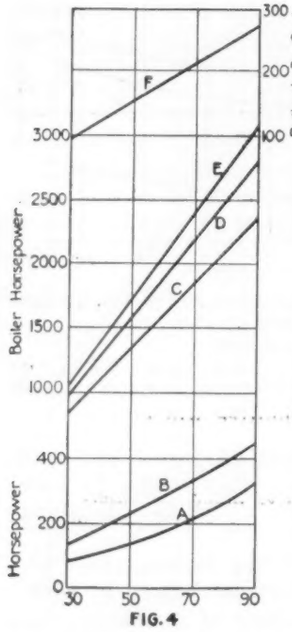


FIG. 4

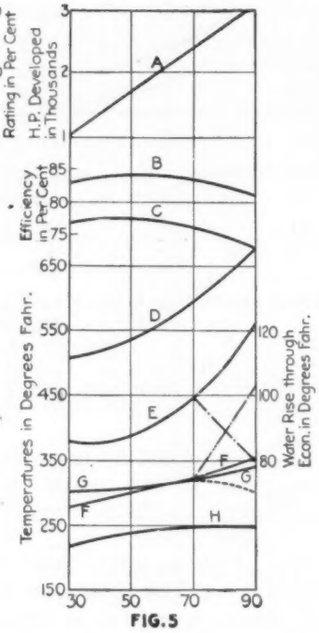


FIG. 5

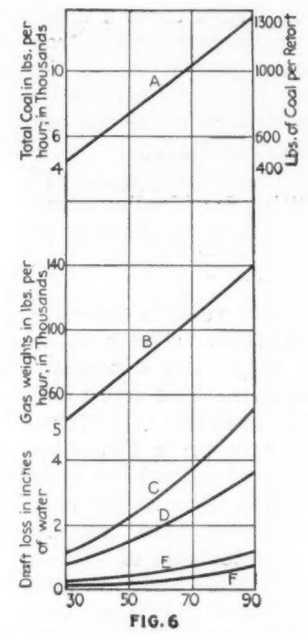


FIG. 6

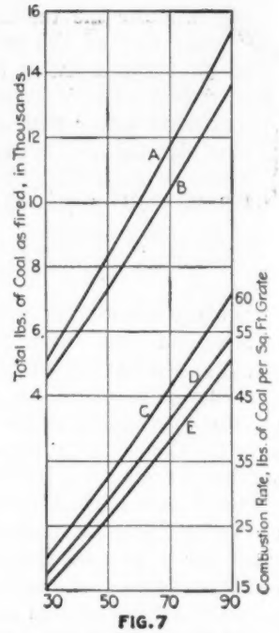


FIG. 7

Fig. 4—Curves Developed in the Study of Plant Design to Determine the Equipment to Be Used

The horsepower developed by the economizer and superheater are shown separately and in combined form with the boiler capacity to indicate the influence of this apparatus on the selection of boiler capacity. A is the horsepower developed by economizer; B, the horsepower developed by superheater; C, the horsepower developed by boiler; D, the horsepower developed by boiler and superheater; E, the horsepower developed by boiler, superheater and economizer, and F, the rating on boiler and superheater.

Anticipated results in operation of 1,024-hp. water-tube boiler, twenty sections wide, eight groups high, tubes 20 ft. in length, with 6,300 sq.ft. of heating surface; economizer seven elements wide and twenty high, each 15 ft. long. Curves are based on 9,300-B.t.u. bituminous coal (Fulton County), with combustion having 14 per cent CO_2 and combustible in ash not to exceed 15 per cent. Steam pressure, 375 lb. and feed water at 220 deg. F.

Fig. 5—Study of Temperatures of Gases and Water in the Boiler and the Important Efficiencies

A—Total horsepower developed by boiler, superheater and economizer. B—Combined efficiency of boiler, superheater, economizer and stoker. C—Efficiency of boiler. D—Temperature of gases leaving boiler. E—Water temperature rise in economizer. F—Temperature of gases leaving economizer. G—Temperature of water leaving economizer. H—Superheat.

Fig. 6—The Method Used in Analyzing Draft Conditions and Combustion Rates in Coal-Fired Boilers

A—Total coal as fired—combustion rate, pounds coal per retort. B—Gas weights. C—Total draft loss. D—Draft loss through the economizer. E—Draft loss through the boiler. F—Draft loss through the superheater.

Fig. 7—Method of Studying Combustion Rates with Different Grades of Coal and Different-Sized Stokers

A—Total coal as fired, 8,300 B.t.u. B—9,300 B.t.u. coal. C—8,300 B.t.u. coal, twenty-nine tuyères. D—8,300 B.t.u. coal, thirty-three tuyères; 9,300 B.t.u. coal, twenty-nine tuyères. E—9,300 B.t.u. coal, thirty-three tuyères.

ing the temperature of the gases leaving the boiler at the various steam capacities. It is interesting to note the temperature of the gases after going through the economizer. The temperature of the water leaving the economizer is shown, and another curve shows the rise in temperature in passing through the economizer. The temperature of the water leaving the economizer is higher than the temperature of the gases leaving the economizer at the lower rating. This is due to counterflow of the water and the gases, working on the same principle as the cooling water in the condensing system. Arrangements have been made for bypassing the gases around the economizer at the higher ratings to avoid the excessive drop in draft at these loads. Under general operating conditions operation should be at the lower points. It is not wise to increase the investment for draft equipment to handle the higher ratings as it is only in service for short periods. It is more economical to waste some heat during these short periods. It is also interesting to note the efficiency curve for the boiler and stoker, which in this particular instance was figured at 40,000 lb. of steam per hour at 77.6 per cent for the boiler and stoker alone, whereas at the same rating the combined efficiency of the boiler, stoker and economizer shows a total efficiency of 84.5 per cent. The equipment throughout is designed to be operated at 300 per cent rating when desired. Normally operation will be at 160 per cent, which is at a good point on the efficiency curve.

The curves in Fig. 6 are interesting as they show clearly the draft loss through the boiler, economizer and superheater. These data are essential in determining draft conditions.

Fig. 7 shows combustion conditions with reference to the stokers under consideration. Coals of 9,300 B.t.u. and 8,300 B.t.u. were considered, and stokers of twenty-nine and thirty-three tuyères length were analyzed. These curves show coal burned per square foot of grate surface at the various ratings. It has been our experience with low-grade Western coal that most satisfactory operation is obtained when the coal per square foot of grate is kept below 50 lb. If the rate of combustion exceed this point, the coal can be burned, but considerable difficulty is experienced with clinkers.

Austrian Electrical Industry Steady

THE Austrian electrical industry is withstanding the period of deflation better than most others in that country, according to reports to the Department of Commerce from Trade Commissioner Upson. One of the leading Vienna factories had been running, fully manned, until last November, since which time between three hundred and four hundred hands have been gradually discharged. Those remaining, however, are at present working full time. The wages of the workmen are now about 60 per cent of the pre-war amount, taking the crown at its exchange value, but in real purchasing value, according to the *Volkswirt* index of living costs, they are 95 per cent of pre-war wages. The official March index for living costs gives this same percentage of 84.5.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Systematic Analytical Procedure Essential to Engineering Research

To the Editors of the ELECTRICAL WORLD:

Referring to your recent editorial on the problem of insulation, as described in the report of the committee on electrical insulation of the National Research Council published in the *Journal of the A. I. E. E.* for June, permit me to add a few words for your readers concerning the plans and hopes of the committee.

The problem of insulation is as old as electrical science itself. Electricity was first discovered through a property of dielectrics, and throughout the whole period of electrical research and development many of the profoundest thinkers and investigators, from Cavendish, Faraday and Maxwell to the present, have devoted their efforts to the study of this great problem. Pure and applied scientific literature is teeming with the results of experiment and with speculation as to the nature of the phenomena observed. Yet the results of all this labor have not brought us very far. The principal properties of dielectrics are well recognized, and great masses of data as to their variation in different materials and under different conditions have been accumulated. But the ultimate nature of these properties is as yet unknown. Even so simple a question as whether or not a pure dielectric possesses the property of absorption cannot be answered with certainty. We now know a great deal about the electron, and especially that it is the essential electric constituent of all matter, but as to its function in the atom of the dielectric, what part it plays in dielectric displacement, absorption and conduction, we are still almost entirely in the dark.

Physicists in recent years appear to have lost their immediate interest in dielectrics and to have turned their attention to the atom in the gaseous state, probably realizing that through that path lies the ultimate shortest route to a true understanding of all properties of matter, including those of dielectrics. Not so the engineer, however. His interest in dielectrics is keener and more immediate than ever. Each day brings him problems demanding wider ranges of values of insulation constants and more varied combinations of properties to keep pace with the new demands and developments of all types of electrical equipment. He cannot wait for the more systematic and leisurely physicist and so he must, in his own way, be at the problem of insulation continually. With his direct studies of breakdown, loss and phase angle, he takes it, as it were, from the top and does not go very deep, while the physicist takes it from the lowest bottom he can find, upward. But in spite of their enterprise, energy and outpouring of effort and expense, the engineers are finding that their method is not yielding proportionate results. They do not yet know their insulation. They cannot design it to a certain performance.

Now the gospel that the committee on electrical insulation is preaching is that the engineers can succeed only if they will follow the methods of the physicist, using the while their own greater facilities and experience with high voltage, high frequency, current and energy in large values—things not usually at the disposal of the physicist, or at which he often balks. Combine the right method, scientific knowledge and engineering skill and resources, and big progress is sure to result.

The needs, then, are the right men and their time. Many of these men are in industrial research laboratories, some in colleges and universities, some in national and independent scientific bodies. Their combined effort is needed. How can their services be had? The first essential is a willingness, or rather desire, to take a hand. Given this, no matter where a man is, he can do something. But, wherever he may be, if he will make himself known, the committee will make a good effort to see that a suitable proportion of his time is made available for one of the most stimulating of all research problems. It is a call to those genuinely interested in research and also to those who have influence over or control of such men.

The plans of the committee call first for a systematic collection of data under the various headings of the report. Thus the first need is for a few men skilled in reading and abstracting scientific literature. Coordination, publication, experimental attack will then follow in their order. The committee will welcome not only volunteers, but all contributions and correspondence in connection with the problem of insulation.

J. B. WHITEHEAD,
Chairman.

Johns Hopkins University,
Baltimore, Md.

Architect and Electrical Engineer

To the Editors of the ELECTRICAL WORLD:

I have read with interest M. M. Samuels' recent article in the ELECTRICAL WORLD entitled "Architect and Electrical Engineer." The practice of drawing a detailed sketch of the method of suspension of luminaires for all classes of work is most excellent and not only gives the electrical contractor definite instructions as to the method of installation, but also prevents substitution of inferior material.

On specifications where the job runs to considerable magnitude it is always best practice to include sketches of fixtures with their method of suspension and refer to them in the plan as fixture types. This plan has been adopted by several large industrial organizations, such as the General Motors Company and the Durant Motors Company, at the instance of their consulting engineer, H. E. Somes.

D. H. TUCK,
Electrical Engineer.

Holophane Glass Company,
New York.

To the Editors of the ELECTRICAL WORLD:

What M. M. Samuels says with reference to co-operation between the architect and the electrical engineer is true. Strange to say, there are few buildings which demonstrate that the genius of both has been properly applied. In my estimation the proper lighting of the building is fundamental. As the modeling of all architecture depends on lights and shadows from the sun, it is equally true that the interior work needs the same application, which artificial lighting, if properly installed, can provide.

I certainly hope that the electrical industry will have continued success in bringing the electrical engineer and the architect closer together.

R. C. EDWARDS,
Sales Department.

Radio Corporation of America,
New York, N. Y.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Soil Temperatures and Cable Rating

Summer and Winter Ratings of Cables, Location and Method of Testings, Effect of Cloudiness, Snow, Range of Temperature and Cable Capacity Discussed

By A. Smirnoff
Potomac Electric Power Company, Washington, D. C.

SURROUNDING soil temperature is one of the most important factors in calculations of the current-carrying capacity of underground cables. As virtually all of the information on soil temperatures previously collected has been gathered chiefly in the interest of agriculture, the soil temperatures obtained are not applicable. Usually this temperature has been assumed, so in order to obtain more accurate information the Potomac Electric Power Company of Washington, D. C., in co-operation with the United States Bureau of Standards, authorized an extensive investigation of soil temperatures. It was found that a cable may reach the provisionally accepted temperature limit of 85 deg. C. with a loading of 150 amp. in the summer or may be safely loaded up to 230 amp. in the winter without reaching the temperature limit. These figures are for a three-conductor No. 4/0 13,200-volt cable.

The warmest soil temperature exists under black asphalt, which, besides absorbing the sun heat, prevents the moisture from penetrating into the soil. By actual measurements, the temperature of the asphalt in Washington, D. C., repeatedly reached 75 deg. to 80 deg. C. at the surface last summer, despite the fact that the season was not exceptionally warm.

The apparatus used for testing consisted of three resistance coils 2.5 ft. long in waterproof covers, as shown in Fig. 1. These coils were calibrated, including their leads, and driven horizontally under the asphalt-paved streets. The depths selected were 18 in., 27 in. and 36 in., corresponding to the duct spacing, as shown in Fig. 3. The location was selected on a north-south street near a corner, so as to have maximum exposure to the sun and still be a sufficient distance away from other duct lines and underground construction to avoid their influence.

The resistance of the three coils was measured with a Wheatstone bridge in a substation 600 ft. away. These readings were taken every three hours for a period of one year. At the same time other data were collected and recorded with the object of determining the influence of meteorological conditions on the soil temperature.

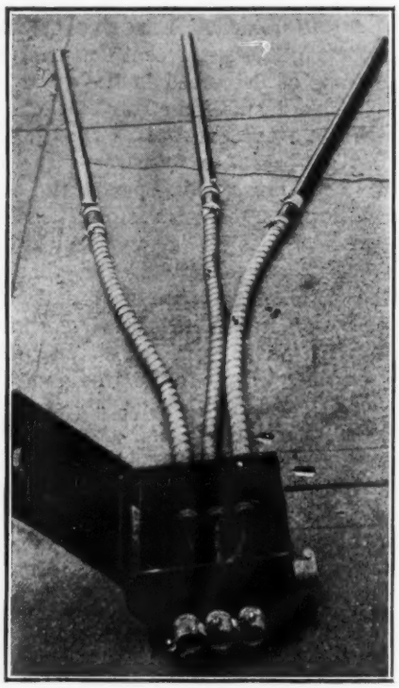


FIG. 1—RESISTANCE COILS USED TO DETERMINE TEMPERATURE OF SOIL

From the readings and information obtained the curves in Fig. 2

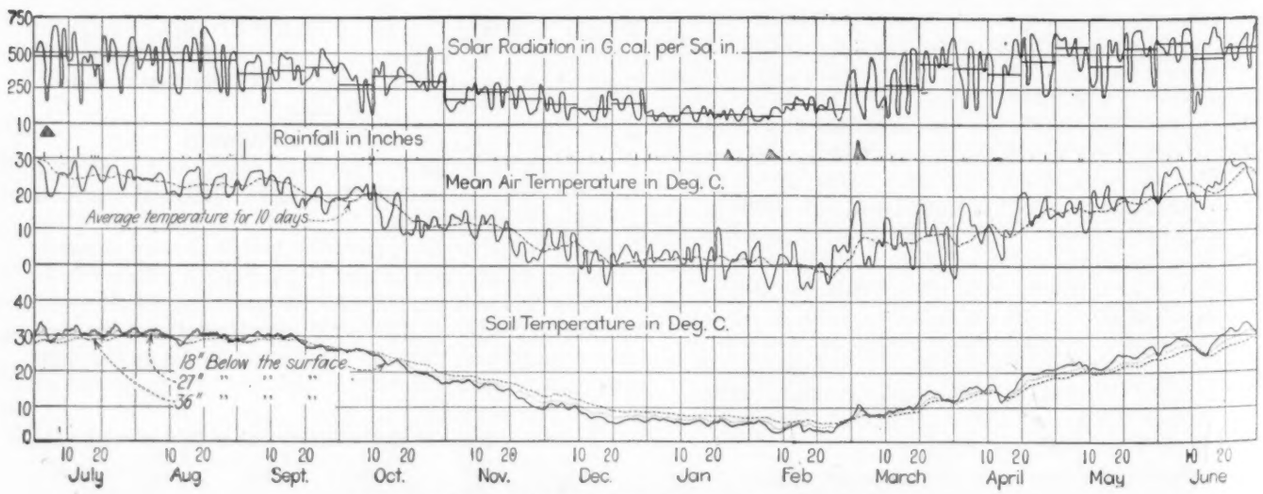


FIG. 2—SOIL AND AIR TEMPERATURE FOR ONE YEAR PERIOD

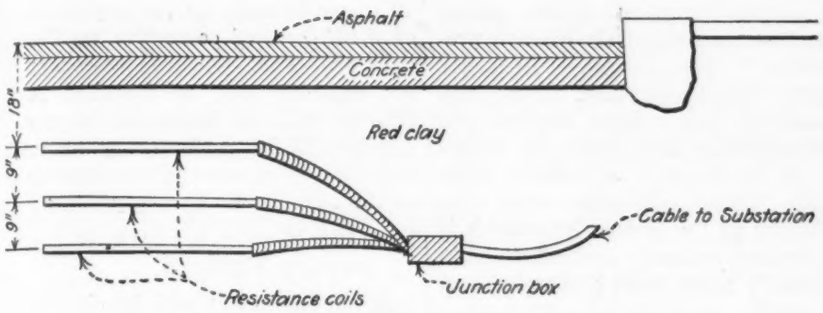


FIG. 3—RELATIVE LOCATION OF EACH RESISTANCE COIL

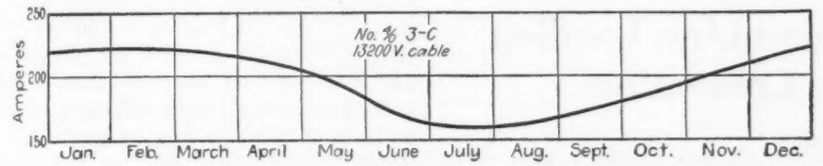


FIG. 4—CURRENT-CARRYING CAPACITY OF THREE-CONDUCTOR NO. 4/0 13,200-VOLT CABLES

were constructed. By analyzing this drawing it is found that the range of soil temperature at the depths recorded is from 3 deg. C. in the winter up to 35 deg. C. in the summer. As a result the current-carrying capacity of the cables varies considerably. Using the formula given by R. W. Atkinson in the *Journal of the A. I. E. E.*, September, 1920, a chart (Fig. 5) was prepared showing the variation of the current-carrying capacity of a few cables due to the variation in the soil temperature and the number of cables in the duct.

The average mean daily temperature when compared with the soil temperature was found to be 8 deg. C. lower than the soil temperature. Rain usually has no influence as it does not penetrate into the soil sufficiently, but emphasis should be placed on the total time of cloudiness of the day as shown by the amount of heat thrown on the surface. As asphalt readily absorbs the heat, especially during the summer, the temperature of the soil nearest to the surface shows big variations, closely corresponding to the amount of heat received by the surface. The heat-absorbing capacity of the asphalt is destroyed as soon as the streets are covered with snow and the result is a rapid fall in temperature.

Other interesting facts brought out by the investigation were that cables carrying heavy summer loads should be placed as deep as possible, whereas cables carrying heavy winter loads should be placed nearer the surface. The highest temperature of the soil for twenty-four hours is usually about 9 p.m., while the lowest is about 9 a.m., the variations being often as much as 4 deg. C. in the summer. Practical application of the investigation is shown in Fig. 4. This chart is drawn in accordance with the measured soil temperatures showing the limitations of three three-conductor No. 4/0 13,200-volt cables during the different months of the year.

Although these calculations pertain to Washington, D. C., they may be applied for any other city with certain changes in accordance with the meteorological conditions existing there. To arrive at the approximate soil temperature under the asphalt it is necessary to add 8 deg. C. to the mean weekly average temperature, and up to 12 deg. C. if the sky is mostly clear, making this allowance for accumulative heat. Regions covered for long periods with snow will naturally show a much lower temperature, but it must be considered that in most cities snow is soon removed.

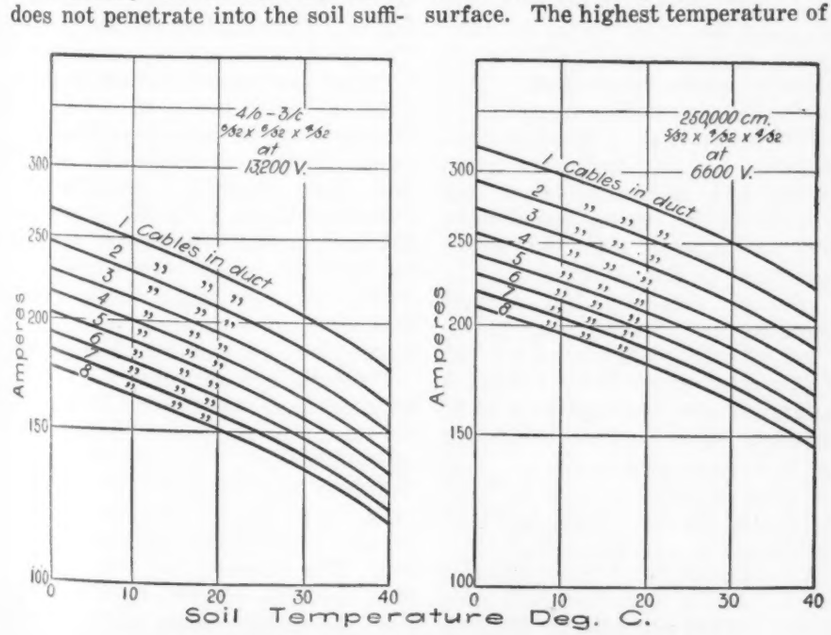


FIG. 4—CURRENT-CARRYING CAPACITY OF THREE-CONDUCTOR

Practical Utilization of Small Water Powers

AUTOMATIC or semi-automatic generating stations for economically utilizing the water power of small streams are receiving the attention of power companies of California, according to the technical sub-committees of the Pacific Coast Electrical Association. The Southern California Edison Company has fourteen plants, aggregating 15,000 kw., under semi-automatic operation. These plants would be economically impracticable if it were necessary to employ manual operation.

Operating experience with automatic equipment shows that it is possible to duplicate every operation of manual control, even to observing the operating conditions of an automatic station at some distant point. A system of supervisory control is being worked out by one of the large manufacturers by means of which it is possible to listen in over a single pair of wires on the operation of the station at some distant point and determine the position of circuit breakers, water level, load on the station, hot bearings, etc.

Most plants now in operation are semi-automatic rather than full automatic because it is necessary to have at least one man on the property as a watchman, and this man is

on duty at all times to start up the plant in case it is "kicked off" the line.

The present tendency in design of these plants is toward the use of induction generators, although the majority of plants now in operation are equipped with synchronous generators. The investigation of the apparatus committee indicates that the economic limit of the automatic generating plant is from 1,500 kw. to 2,000 kw. and below, or that it is suitable for plants where operating costs are relatively high in proportion to fixed charges. In larger plants with high load factor and relatively heavy fixed charges per kilowatt-hour, and where the capacity of the plant is such that a shutdown would seriously affect the capacity of the system into which it is feeding, manually controlled plants generally prove more economical and desirable.

Increasing Transmission-Line Loading by Power-Factor Correction

BY F. L. HUNT
Chief Engineer Turners Falls Power & Electric Company, Greenfield, Mass.

THERE are many advantages to operating companies in power-factor correction. One which may not always be realized is the possibility of increasing the loading of transmission lines by corrective measures. Most power-factor correction problems need to be worked out individually before a sound conclusion can be reached, but I am not sure that we always realize when we have a power-factor correction problem before us. I have discovered in recent months two or three cases where I thought we had a problem of increasing transmission or distribution facilities and where at some earlier time we had actually figured out that certain increases in loads would require certain additional circuits. Upon going into these problems again and carefully considering all the possibilities of power-factor correction, we discovered that the additional capacity required could be obtained at much less investment and more satisfactorily by power-factor correction than by additional circuits.

The capacity of most overhead circuits is limited by the voltage drop occurring in those circuits. When the voltage drop in a given circuit has reached the maximum that can be allowed and still maintain good service, then the circuit is for practical purposes loaded. If new business or other conditions make it desirable to double the load on that circuit, it may be taken care of by duplicating the circuit.

It is a question if all engineers realize that a No. 1/0 three-phase, 60-cycle overhead circuit operating at a voltage of 10,000 or more will carry twice as much load at unity power factor with a given voltage drop as it will carry at 75 per cent power factor at the same voltage drop. It may cost less to bring the power factor from 75 per cent to unity than to duplicate the circuit.

This point may perhaps be best illustrated by a concrete example. Two No. 1/0 circuits will deliver 20,000 kw. at 75 per cent power factor a distance of 40 miles at 66,000 volts, three-phase, 60 cycles, at an energy loss of 10 per cent and a voltage drop of 12.3 per cent in line alone. If one wishes to add 20,000 kw. more load at 75 per cent power factor, the same voltage can be maintained by building two more No. 1/0 circuits. Two No. 1/0 circuits, 40 miles long, built for operation at 66,000 volts, will cost at least $500,000.

CHEAPER TO RAISE POWER FACTOR

The power factor of this 40,000-kw. transmission is 75 per cent. We can raise the power factor to unity by the application of 36,000 kva. of wattless corrective effect. This synchronous condenser capacity installed would not cost more than $200,000, and the saving in transformer and generator losses and capacity in the system would more than compensate for the losses introduced by the condenser.

Likewise two No. 1/0 circuits operating at 13,200 volts, three-phase, 60 cycles, will carry 3,000 kw. at 75 per cent power factor a distance of 8 miles with a voltage drop of 10 per cent. If we wish to carry 6,000 kw. at 75 per cent power factor over the same distance, we may do it by duplicating the two circuits and hold our voltage drop at 10 per cent.

A two-circuit No. 1/0 line suitable for 13,200-volt operation will cost at least $3,500 per mile, or $28,000. The power factor of this load may be raised to unity by the application of 5,400 kva. of corrective wattless current. This synchronous-condenser capacity may be installed for $20,000 and the losses in the condenser will be made up by saving losses in generators and transformers in the circuit.

SMALLER MARGIN OF GAIN AT LOW VOLTAGES

A similar result will be obtained in applying this principle to lower-voltage problems. We recently had a case where the load on a 4,000-volt circuit could be doubled by power-factor correction cheaper than by adding another circuit, although the margin of gain is not so great at lower voltages, because the cost of power-factor correction increases as the size of units is reduced and the proportional cost of lines on short low-voltage circuits is less.

If power-factor correction has proved to be the most economical in a 4,600-volt circuit, it is probable that there are a great many cases at voltages between 4,600 and 66,000 where it should be adopted.

There are sometimes other reasons for increasing the number of circuits when an increase in load occurs on a transmission line, but in the absence of such necessity the points brought out above regarding the possibility of increasing the capacity of transmission circuits by raising the power factor are worthy of consideration.

The cheapest power-factor correction possible to get is that obtained through synchronous motors running at 80 per cent power factor or higher. The next best method is the use of so-called motor condensers carrying some load but operating at a power factor below 80 per cent. Where no motor application can be made, synchronous condensers offer the next cheapest power-factor correction down to units of from 300 kva. to 600 kva., depending on the cost of power for supplying losses. In most cases static condensers are the cheapest corrective apparatus in units of 300 kva. or less.

I should like to suggest to the manufacturers that they would assist the operating companies materially in making use of synchronous-condenser machinery if they could build high-speed condensers to operate more quietly than they do now. The excessive noise made by these machines prevents their use in some substations where they might otherwise be economically used.

STREET LIGHTS OUT

PROVIDENCE R I. MONTH Feb. 1923

	MAGNETITE ARCS				INCANDESCENTS							
	UNDERGROUND		OVERHEAD		ALL NIGHT				HALF NIGHT			
					UNDERGROUND		OVERHEAD		UNDERGROUND		OVERHEAD	
	NO OF LAMPS OUT	HOURS OF OUTAGE	NO OF LAMPS OUT	HOURS OF OUTAGE	NO. OF LAMPS OUT	HOURS OF OUTAGE	NO OF LAMPS OUT	HOURS OF OUTAGE	NO. OF LAMPS OUT	HOURS OF OUTAGE	NO OF LAMPS OUT	HOURS OF OUTAGE
Out from circuit troubles	421	Hrs. Mins. 721 05	216	Hrs. Mins. 365-50								
Out from lamp troubles	484	1335-30	267	750-35								
Totals	905	2056-35	483	1116-25								
Number of circuit troubles	8		5									

Thousands hours burned, arcs 562 23 — Total hours outage, arcs 3173.00

No outages for lamp troubles, " 751 — Per cent hours out " 0 564

No " " " " per 1,000 hours burned, arcs 1336

OUTAGES PER 1,000 HOURS BURNED CONSTITUTE INDEX FIGURE IN SERVICE ANALYSES

Analyzing Causes of Outages in Street Lighting

MANY municipalities and utilities confine their analyses of street-lighting outage to the number of lamp-hours per month lost from the scheduled service. While this figure is a measure of the community's deprivation of highway illumination owing to apparatus failure, it does not give an adequate check upon the performance of the equipment. After an outage is reported by the police, the time required for the operating force to restore service varies widely and is inevitably a part of the outage period. To enable the working of the equipment to be checked more closely, and in the hope that others will establish and maintain similar comparisons, R. W. Eaton, public service engineer of the city of Providence, R. I., uses the accompanying tabular analysis of local street-lighting service. For convenience in emphasizing the arc-lighting results here given, the incandescent lighting data for the month chosen are omitted.

The Providence service is tabulated on the basis of the number of lamps out and the hours of outage for both overhead and underground supplied lamps, and the causes of outage, whether from circuit or lamp troubles, are also separately shown. The total number of hours burned, total hours of outage, number of outages for lamp troubles and percentage of hours out represented by arc-lamp outages are shown. From these data are computed an index figure of arc-lamp service, viz., the number of outages for arc lamp troubles per 1,000 hours burned, this being 1.336 for February, 1923, on the system of about 1,600 6.6-amp. magnetite-arc lamps without high-efficiency electrodes. This index figure is plotted from month to month for comparisons on a time basis, and it has been found that a seasonal variation exists, with a tendency toward more outages in winter than in summer.

Load Dispatcher's Control Board

BY A. O. EVANS
Arkansas Light & Power Company, Pine Bluff, Ark.

IN ORDER to assist the dispatcher in checking operations on the central power system of the Arkansas Light & Power Company, Pine Bluff, Ark., the control board shown herewith was devised. Battery switches represent every switch on the main transmission lines and miniature lamps are placed at every substation and are so wired that they show actual operating conditions. Energy for the lamps is supplied by a small transformer.

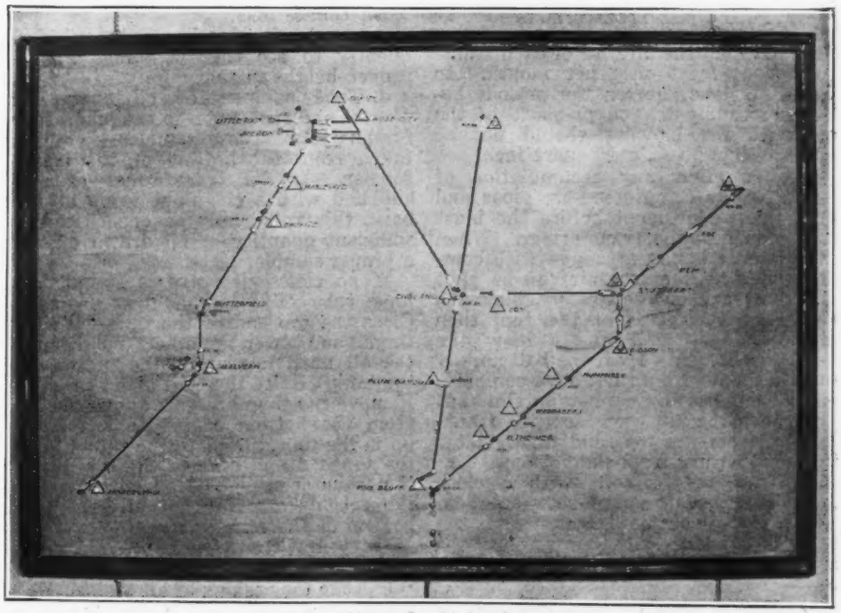
The use of this board affords the system operator, at a glance, a record of the position of all switches. This proves of most value during electrical storms, when switching must be effected rapidly, and aids in checking against throwing together without synchronizing two or more of the four generating stations that supply power to this system.

About twenty-six communities are supplied with electrical service from this system, which also supplies electricity for hundreds of irrigation plants in the rice-growing section of Arkansas. The generating stations are at Pine Bluff, Picron and Malvern. The Arkansas Light & Power Company recently completed a 66,000-volt line connecting the Pine Bluff-Picron system with the Arkadelphia-Malvern system. This line is being extended to the site of the Remmel dam and power station under construction on the Ouachita River by the company, which plans the building of a total of three dams and power stations to develop 120,000 hp.

Molten Additions to Steel

BY FRANK HODSON
President Electric Furnace Construction Company, Philadelphia, Pa.

IT IS generally agreed that it is very desirable to make molten ferro-manganese additions to open-hearth and converter steels rather than to add cold unmelted metal. The electric furnace has made it possible to do this in a simple and efficient manner. A properly designed electric arc furnace with bottom contact to insure circulation in the bath and a large bath area to permit of proper slag manipulation



COMPLETE CONTROL OF SYSTEM FACILITATED BY THIS DISPATCHING BOARD

will solve many of the melting difficulties and insure at a low operating cost supplies of hot liquid ferro-manganese.

In addition to better quality of steel, smaller amount of ferro and absence of melting loss, savings can be made by the use of manganese ore and low-grade ferro-manganese. Both of these can be used in the electric furnace. In experiments made on a "Greaves-Etchells" furnace—which has the particular advantage of operation either entirely with top electrodes or with top electrodes and the whole of the furnace hearth—as much as 25 per cent of the charge was added in the form of manganese ore. The metallic melting loss rarely exceeds 3 per cent.

For proper metallurgical manipulation of ferro-manganese it seems highly desirable to use an electric furnace with a large open bath rather than a restricted channel as in the induction furnace, and also one in which there is a circulation from the bottom of the furnace. It was found that when only top heat was applied the manganese had a tendency to segregate out and sink to the bottom, where it would stick. When the bottom connection on the furnace was cut in this tendency ceased and the metal was uniform throughout in temperature and composition.

The voltage required on melting ferro-manganese differs considerably from that needed for steel, and in order to keep a steady arc, and if necessary to hold the furnace on low power imput, it is important to have a furnace in which each electrode operates independently and which can keep steady arcs with only 20 per cent to 25 per cent of normal electrode load. A four-electrode furnace with one phase attached to furnace hearth, giving slow circulation of metal from the bottom, is ideal for ferro-manganese or for any alloy or high-grade steel.

Extracts from an Operating Code*

Cleaning Transformers

AN AIR-BLAST transformer must be kept as free as possible from dust, especially the ventilating duct, so that the air can penetrate to all parts of the transformer that require cooling. With oil-insulated self-cooled units the oil must be tested periodically for moisture. In the case of oil-insulated water-cooled transformers the oil level must be carefully watched. Instructions follow:

Air-Blast Transformers

1. Blow out the interior of each transformer at least once per month. In dirty locations shorten the periods between cleanings. The pressure of the air used for blowing should not be greater than 70 lb. per square inch.

Always allow any accumulation of water in the compressed-air pipes and tank to be blown out before the blast is turned into the transformer. When the air chamber is arranged with compartments so that the air can be shut off from each one separately, blow the transformer first from the top, then clean the pit, and finally blow the transformer again from the bottom. If the air chamber does not have compartments and the air cannot be shut off, first clean the pit, then blow the transformer from the top, and finally blow the transformer from the bottom.

2. Wipe off the coils with a cloth and clean the air space between them with a brush or cloth fastened to the end of a stick.

3. Clean all connections, insulation and cable racks underneath the transformer and wipe the dirt from the casing.

4. At the time the transformer is blown make a thorough inspection for loose contacts, imperfect connections or any other defects likely to affect the operation of the transformer.

5. Where transformers are equipped with regulating mechanism for adjusting the voltage, inspect it monthly.

Oil-Insulated Self-Cooled Units

1. Keep the casings of all oil-insulated transformers clean and inspect the leads for oil siphoning and loose connections.

2. Inspect the percentage taps for loose connections.

3. Check the level of the oil frequently to see that it stands at the proper height in the gage.

4. Take samples of oil every six months and send them to the laboratory for analysis. These samples should be taken from the bottom of the transformer. If the transformer case is supplied with a clean-out valve at the base, this valve may be opened and a sufficient quantity of oil drawn off for a proper sample.

If no clean-out valve is supplied, a long tube of glass or fiber is used. Close the top end of the tube with the thumb and lower the other end through the oil until it reaches the bottom of the tank. Raise the tube about an inch. Remove the thumb. This allows the oil from the bottom of the tank to flow up in the tube. Replace the thumb over the top end and remove the tube from the transformer. The oil entrapped in the tube is a sample of oil from the bottom of the case.

Oil-Insulated Water-Cooled Units

1. Keep the casings of all oil-insulated transformers clean and inspect the leads for oil siphoning and loose connections.

2. Inspect the percentage taps for loose connections.

3. Check the level of the oil frequently, as a continuous rise in oil level indicates water leaks.

4. Clean out the cooling coils periodically.

5. Take samples of oil every six months and send them to the laboratory for analysis.

*Abstracted from the operating code of the Philadelphia Electric Company.

Making Overspeed Tests on Auxiliary Turbines

AT SPECIFIED intervals tests should be conducted to determine whether or not the overspeed devices on small auxiliary turbines are in satisfactory operating condition. In making these tests the governor should be blocked in some manner and the machine controlled by the throttle so that the speed may be increased above normal as desired. Following are the directions for making overspeed tests on small turbines:

1. See that the load of the turbine has been removed.

2. Apply a tachometer to the turbine shaft and note that normal speed is maintained by the governor at no load.

3. Continue to observe the speed by means of the tachometer and force the governor arm against the spring, allowing the turbine to speed up not exceeding 20 per cent above the normal speed.

4. Note the speed at which the overspeed device trips the throttle. If it has not operated when 20 per cent overspeed is reached, adjust the tripping mechanism to operate at a lower speed.

Barriers Prevent Squirrels from "Shorting" Lines

BY J. G. ALLEN
Vice-President Southern Wisconsin Electric Company, Lake Geneva, Wis.

SINCE seven of the nine service interruptions during one year on a 26,000-volt line of the Southern Wisconsin Electric Company had been caused by squirrels short-circuiting the conductors, the company decided to find some method which would prevent squirrels from climbing the poles. It was found that when an 18-in. strip of galvanized tin was nailed around the pole the squirrels were unable to climb over the tin. Consequently, during the past two years five hundred poles have been protected in this manner at a cost per pole of 65 cents. Of that amount, 52 cents went toward the cost of the material itself, which is so thin that a lineman's spur can penetrate it. Formerly trouble caused by squirrels was frequent on the open prairie lines as well as long wood lots, but no trouble has been experienced since this method of protection was placed in service.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Effect of Time Interval and Type of Load Upon Integrated Kilowatt-Hour Demand

IN MEASURING the demand of power loads the duration of the time interval and the type of load under consideration have all-important influences on what shall be taken as the demand for billing purposes under a demand and energy rate. How both of these factors affect the ultimate result in measuring demand is shown in the accompanying tabulation of integrated demands for different industries which has been compiled by William M. Carpenter, engineer for the Empire State Gas & Electric Association, New York.

To obtain this data graphic wattmeter charts of typical industries were taken at random as representing an ordinary day's work. From these the peaks were selected and the relation of values found by using the various time intervals as shown in the tabulation. The different industries have been grouped into three natural divisions: Steady, intermittent and heavy metal-working loads.

It will be seen that under the classification of steady loads there is not a great difference between the hourly maximum and the instantaneous demand, the greatest difference being shown by an electric furnace, while the average instantaneous demand for the group exceeds the hourly demand by only 14.3 per cent. The importance of the shorter time interval becomes more apparent with the intermittent loads where the fifteen-minute demand of a machine shop exceeds the hourly demand by 25 per cent, and the instantaneous demand shows an excess of 62 per cent. The average instantaneous demand of this group exceeds the hourly demand by 37.2 per cent.

The heavy metal-working loads show the widest diference between hourly and instantaneous demands, although the integrated peak over a two-minute period exceeds that of the hourly period by only 24.7 per cent. However, the average instantaneous demand of this group is 48.5 per cent more than the hourly demand.

The results of this comparison indicate the importance of a careful consideration of the time interval and kind of metering device which

INTEGRATED DEMAND AS MEASURED BY VARIOUS LENGTHS OF PEAKS COMPARED WITH ACTUAL USE IN MAXIMUM HOUR

Industry	1 Hour, Kw.	Per Cent of Hourly Demand	30 Minutes, Kw.	Per Cent of Hourly Demand	15 Minutes, Kw.	Per Cent of Hourly Demand	10 Minutes, Kw.	Per Cent of Hourly Demand	5 Minutes, Kw.	Per Cent of Hourly Demand	2 Minutes, Kw.	Per Cent of Hourly Demand	Instantaneous Kw.	Per Cent of Hourly Demand
Steady loads:														
Pumping plant	154	100	154	100	154	100	154	100	154	100	154	100	154	100
Flour mill	5,000	100	5,000	100	5,000	100	5,000	100	5,000	100	5,000	100	5,250	105
Flour mill	510	100	525	103	530	104	530	104	540	106	540	106	560	110
Refrigeration	930	100	940	101	965	104	980	105	1,000	107	1,005	108	1,020	110
Refrigeration (bottling works)	600	100	625	102	630	103	635	104	640	105	640	105	740	121
Refrigeration (ice-cream manufacturing)	128	100	130	101	132	103	132	103	132	103	134	105	137	107
Refrigeration (cold storage)	84	100	85	101	88	105	90	107	91	108	91	108	98	117
Refrigeration (cold storage)	130	100	135	104	138	106	140	108	145	111	146	112	148	114
Electric furnace	430	100	440	102	440	102	445	103	450	105	460	107	460	107
Electric furnace	370	100	378	102	380	103	380	103	380	103	380	103	385	104
Electric furnace	200	100	215	107	220	110	225	113	225	113	230	115	240	120
Electric furnace	110	100	110	100	110	100	110	100	115	104	120	109	150	136
Paper mill	4,250	100	4,500	106	4,550	107	4,600	108	4,700	111	4,800	113	5,150	121
Paper mill	750	100	760	101	785	104	790	105	790	105	790	105	840	112
Paper mill	520	100	590	113	640	123	660	127	670	129	670	129	680	131
Paper mill	455	100	480	105	500	110	500	110	500	110	500	110	520	114
Paper mill	360	100	380	105	390	108	382	109	400	111	400	111	410	114
Wallpaper manufacturing	410	100	440	107	440	107	445	108	450	109	450	109	460	112
Talc mill	1,070	100	1,170	109	1,170	109	1,170	109	1,170	109	1,170	109	1,170	109
Fertilizer mill	112	100	116	103	125	111	135	120	137	122	138	127	140	125
Average of group		100		103.6		106		107.3		108.6		109.3		114.3
Intermittent loads:														
Machine shop	1,150	100	1,160	101	1,180	102	1,200	104	1,210	105	1,220	106	1,300	113
Machine shop	355	100	355	100	360	101	370	104	372	105	375	106	425	120
Machine shop	168	100	200	119	210	125	215	128	220	131	220	131	272	162
Machine (railway shop)	108	100	113	104	118	109	120	111	126	116	130	120	140	130
Machine (railway shop)	74	100	90	107	97	115	98	117	100	119	100	119	112	151
Packing house	49	100	64	131	66	135	67	137	75	153	80	163	82	166
Office building (hydraulic elevators)	90	100	90	100	90	100	90	100	120	133	125	139	138	154
Lithographing shop	290	100	325	112	340	117	345	122	360	124	360	124	381	131
Evening newspaper	540	100	620	115	690	128	710	131	740	137	750	139	800	148
City street railroad	5,500	100	6,220	113	6,450	117	6,500	118	6,500	118	6,500	118	6,900	125
Foundry	140	100	145	103	148	105	149	106	149	106	150	107	165	118
Stone crusher	360	100	370	103	380	105	400	111	415	115	420	117	465	129
Lumber mill	550	100	560	102	600	109	615	112	620	113	640	116	760	138
Average of group		100		108.3		112.8		115.5		121		123.4		137.2
Heavy metal-working loads:														
Foundry with electric cranes	1,300	100	1,525	117	1,620	124	1,625	125	1,720	132	1,780	137	1,810	139
Brass rolling mill	3,600	100	4,100	105	4,200	108	4,250	109	4,300	110	4,350	111	4,600	128
Iron rolling mill	4,200	100	4,800	109	5,050	115	5,060	115	5,400	123	5,800	132	7,200	171
Iron rolling mill	1,600	100	1,600	100	1,700	106	1,800	112	1,900	119	1,900	119	2,500	156
Average of group		100		107.7		113.2		115.2		121		124.7		148.5

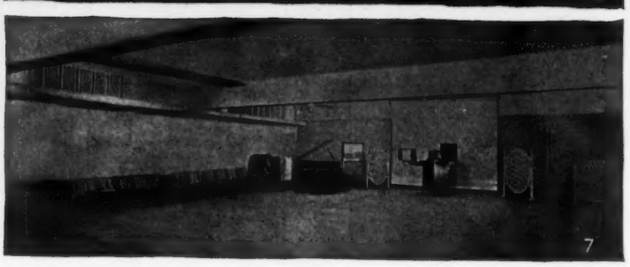
New Utility Office at Albert Lea

Figs. 1 and 2—The main floor in the new office building of the Central States Power Company. The customary grill work has been left off the counters. Note the portion devoted to the smaller appliance sales, with space in the foreground equipped with comfortable chairs and a settee.

Fig. 3—Accounting room on the second floor. An unusually well lighted and cheerful office room. Executives and department heads are at each end of the floor.

Figs. 4 and 5—Views of "The Daylight Corner."

Fig. 6 and 7—The assembly room and well-equipped kitchen in the basement, which have made the office of the company a center for community activities that are not usually thought of in connection with a public utility building. A very nominal amount is charged, which is so low that the lack of profit is evident.



should be adopted for measuring the demand. It should be borne in mind that there is a wide difference between the sustained and instantaneous demands, depending on the type of load. Generally speaking, the shorter the length of the time interval the lower should be the unit price per unit of demand. On the other hand with a long time interval many severe instantaneous or short peaks which might disturb the regulation of that part of a central station distribution system would not be recorded.

In establishing a basis for measuring the demand it appears advisable also to make a careful study of the various industrial loads in the community and the probable trend of future development. Where one type of load predominates in a territory the formulation of a suitable method of determining demand may be comparatively easy, but where industries are widely diversified it becomes a much more difficult problem to find a suitable combination of time interval and meter. The tabulation appears to bear out the experience of most companies that a fifteen-minute peak is the most satisfactory and representative of the average actual demand.

Utility's Quarters Made Community Center

Central States Power Company at Albert Lea, Minn., Equips Its Building for Community Activities—Assembly Room and Kitchen Provided for Use of Civic Clubs

AN UNUSUAL experiment in popularizing the use of the central-station company's office building for commercial and civic club activities has been undertaken by the Central States Power Company, Albert Lea, Minn. The property at Albert Lea, operated by the Southern Minnesota Gas & Electric Company, is a part of a system that is being built up in southern Minnesota and extending into northern Iowa for which the Central States Power Company is the holding company. A new office building has been constructed in the past year and has recently opened its doors. It is located on a conspicuous corner on the main business street, which because of its excellent interior lighting night and day and its exterior lighting at night has become known as "The Daylight Corner."

The main floor is devoted entirely to the handling of customers and the merchandising business. The appearance of this room may be seen on the opposite page.

The accounting rooms, including the consumers' billing, are located on the second floor and shown in Fig. 2. Unusually large windows are provided on the first floor, so that even on a dark day the natural light is strong, and at night, with the interior illuminated, the building stands out sharply.

A new and interesting idea has been worked out in the basement of the building. While a small part of the basement is devoted to appliance storerooms and a place is provided where second-hand appliances can be displayed for sale, the main part of the floor space is divided into two rooms, the smaller being a well-equipped kitchen with cooking equipment and a full supply of dishes and silverware. The larger room is an assembly room equipped with a moving picture machine and a Chickering piano with the best automatic playing equipment. While used partly for employee activities, it also is rented for a nominal amount to any local social or civic organizations that care to use it. The Rotary and similar clubs, women's clubs or like organizations use it for lunches, evening entertainments or any purpose that a general hall would be used for. Labor union organizations have used it for organization entertainment purposes.

It is not the intention of the company to make a profit from renting the hall as the charge for the basement rooms is so small that it does not return any profit. The thought is to make the company's office the center for such activities as have for their aim the advancement of community affairs and to fix the company and its business in a definite relation to such activities. The results so far are very gratifying to the management both because of the good feeling toward the company that has developed and in the attention that has been centered on electrical service and the merchandising activities of the company. Some one of the company's salesforce is on duty on the main floor at night when the basement rooms are being used and the guests are free to drift about, inspect the merchandise or ask questions.

Customers Increase Use and Gain 5.5-Cent Rate

SO SUCCESSFUL has the combined area and energy charge for residential service proved for the Hartford (Conn.) Electric Light Company that beginning July 1 the meter rate was reduced from 8 cents to 5.5 cents per kilowatt-hour, the area charge remaining at 5 cents per month per 100 sq.ft. of flood area. Per customer, the residential kilowatt-hours sold in June, 1923, was 20 against 17 for the same month in 1922 and 1921. The total residence kilowatt-hours was 693,395 for June, 1923, compared with 536,817 for June, 1922, and 497,845 for June, 1921. The combination rate went into effect Dec. 19, 1921, prior to which a 10-cent straight energy charge was in use. The area charge amounts to about 70 cents per month for the average residential customer. In the ELECTRICAL WORLD of April 21, 1923, an account was given of the rate and its application.

What Other Companies Are Doing

Illinois. — The Central Illinois Public Service Company sold more merchandise in one month this summer than ever before in a single month. Its sales for June amounted to $60,793, or 111 per cent more than for the same month last year. The company's merchandise sales for the six months ended June 30, 1923, were $250,627, an increase of $120,881 or 93 per cent over the sales for the first half of last year.

Monroe, Wis.—Causes of weak current and other spasmodic interruptions in electric service are made clear by an instructive window display at the office of the Wisconsin Utilities Company. It explains why the high-tension lines are kept free of trees and their branches. A stump in the window shows a spot which has been badly burned as the result of being near a line. Three insulators, the targets of schoolboys, are also displayed and the disastrous results of lightning are shown.

Worcester, Mass. — An "electric house" will be built during the coming fall and winter by the Electrical League of Worcester County, with the co-operation of the various branches of the industry in that section of Massachusetts in harmony with the plans of the Joint Committee for Business Development.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

English Station with a Rating of 42,375 Kw.—A description is given of the Radcliffe generating station of the Lancashire Electric Power Company in England. The coal-handling plant, ash-removal system, boiler house, turbine room, boiler auxiliaries and switchgear are covered, with some information about operating results. This station has one 2,500-kw., one 3,500-kw., one 4,375-kw., one 6,000-kw. and two 10,000-kw. turbines. The last two machines are standard multistage impulse machines running at a speed of 1,500 r.p.m. and are coupled direct to three-phase, 50-cycle, 11,000-volt generators capable of delivering 13,333 kva. each. —*Electrical Review (England)*, June 15, 1923.

Kansas City Company Adds 30,000 Kw. to System.—T. WILSON.—Increasing power demands necessitated a 30,000-kw. addition to the new Northeast Station of the Kansas City Power & Light Company. The boilers are of the latest design, supplying steam at the temperature of 650 deg. F., and are equipped with forced-draft chain grates and high-pressure counterflow economizers. Provision has also been made for plate-type air preheaters. Other salient features are submerged ashpits, great flexibility in coal handling and provision for rapid transfer to oil fuel.—*Power*, July 3, 1923.

Modern Hydraulic Turbines of Large Capacity.—H. G. ACRES.—The author discusses the subject with special reference to refinements in design, increased efficiency, improved test methods and advances in the general art which make the use of large turbines possible. —*Mechanical Engineering*, August, 1923.

Generation, Control, Switching and Protection

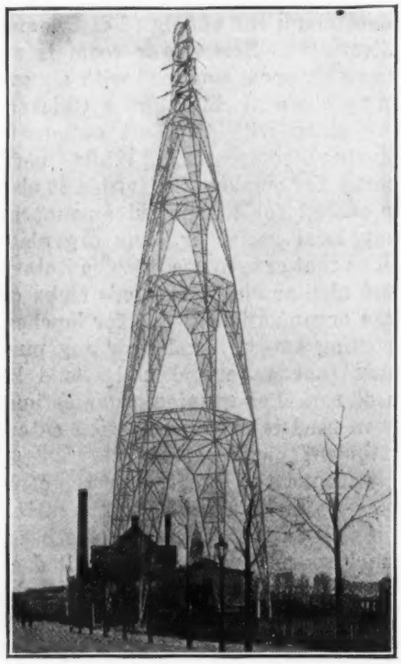
Development of Current Limiting Reactors and Their Shunting Resistors. —F. H. KIERSTEAD.—The author lays much emphasis on the value of shunted resistance as a means of dampening out disturbances. First he gives a brief history of the reactors and then gives the requirements of reactors to meet the exacting conditions met with in modern interconnected systems. — *General Electric Review*, August, 1923.

Polyphase Transformer Connections. —R. F. GOODING.—A comparison of the different three-phase connections of single-phase transformers showing characteristic advantages and disadvantages of connections commonly used. These connections include the delta-to-delta, delta-star, star-delta, star-to-star and three-phase to two-phase.—*Power*, July 24, 1923.

Short-Circuit Forces on Reactor Supports.—R. E. DOHERTY and F. H. KIERSTEAD.—An abstract of this paper may be found in the ELECTRICAL WORLD, report of the A. I. E. E. spring convention, May 5, 1923, on page 1031. —*Journal of A. I. E. E.*, August, 1923.

Transmission, Substations and Distribution

Unusual Transmission-Tower Design. —The 230-ft. transmission tower illustrated herewith is used for Rhine crossings in Holland for a two-circuit, three-phase, 50,000-volt transmission line. This line is part of the network which will ultimately transmit power from eleven provincial power stations to every community in that country.



UNUSUAL TOWER FOR TRANSMITTING ENERGY IN HOLLAND AT 50,000 VOLTS

The 50,000-volt line voltage is considered to be the most economical for the amount of energy that will be transmitted. For Holland it will mean the minimum total generation and transmission cost. — *Sterkstroom*, July 4, 1923.

Economic Design of High-Voltage Transmission Line.—M. SUZUKI.—The first part of this article considers formulas for tower height and weight and gives equations showing the relations between tower weight and span, conductor size and line voltage. The next part is devoted to an economic solution of a transmission line, giving the formula for the calculation of economical conductor size, transmission voltage and span. In the last part an analysis is made of the installation costs of a transmission line, giving unit costs of an up-to-date line. Most of the data are based on the 115,000-volt, 140-mile transmission line of the Inawashiro Hydro-Electric Power Company.—*Journal of Institute of Electrical Engineers of Japan*, June, 1923.

Motors and Control

Electrically Driven Wire-Rod Mill. —The mill described manufactures principally No. 5 and No. 6 gage wire. The building is approximately 560 ft. long by 190 ft. broad and has been equipped with modern devices for handling a large output of finished material. The whole layout and erection of the furnace and the design of the electrical driving equipment is a good example of modern mill practice.—*Electrical Review (England)*, June 15, 1923.

Development of the Steel Industry.—D. M. PETTY and A. J. STANDING.—A description is given of the enormous manufacturing activities of the Bethlehem Steel Company. Mechanical equipment has largely superseded the necessity for hand labor, and wherever an automatic control can be made operative it is found in service. The authors consider open-hearth furnaces, steel foundries, the forge department, machine shops and rolling mills and discuss the application of electricity to apparatus wherever possible.—*Blast Furnace and Steel Plant*, July 1, 1923.

Induction Motors Used as Synchronous Machines.—S. V. GANAPATI and R. G. PARIKH.—The object of this paper is to determine the overload capacity of an induction motor when operated synchronously and the pulling-in capacity at synchronism. The advantages of synchronous operation of induction motors are most pronounced at times of light load and up to about 70 per cent of full load. At heavier loads there is a loss of efficiency and only a slight improvement in power factor. Owing to the necessity of adjusting the excitation to the load, synchronous operation is unsuitable in the case of fluctuating loads.—*Journal of the Institution of Electrical Engineers (England)*, July, 1923.

Heat Applications and Material Handling

Quenched Arc Welds.—O. H. ESCHHOLZ.—In the process of arc welding an initially cold surface is raised to the melting temperature within the fraction of a second, a small quantity of molten metal is deposited thereon and the fused mass permitted to cool very rapidly. A few examples of this type of welding are given for the purpose of imparting information concerning a better control over residual stress, weld strength, ductility, stress distribution, shock and fatigue resistance.—*Journal of American Welding Society*, June, 1923.

Electric Heating of Finishing Rolls of Sheet and Tin Mills.—GORDON FOX.—The same advantages which accrue to electric heating in many other operations also occur in the application of electric heating to finishing rolls. The heat may be effectively and economically applied and readily controlled and any degree of heat desired may be obtained. The method described is clean, convenient and economical, and the application and operation can be so governed as to offer considerable possibility for decrease in roll breakage.—*Proceedings of Association of Iron and Steel Electrical Engineers*, July, 1923.

Improvements in Ferro-Alloy Electric Furnaces of High Power Input.—B. D. SAKLATWALLA and A. N. ANDERSON.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1025.—*Journal of A. I. E. E.*, August, 1923.

Electrophysics, Electrochemistry and Batteries

Mathematical Development of Theory of Magnetomotive Force of Windings.—A. E. CLAYTON.—The mathematical theory of the magnetomotive force developed by armature windings is developed and presented in such a form that it is at once directly applicable not only to the more common cases, but also to abnormal cases, such as unbalanced windings, pole-changing windings, etc. The method of treatment adopted is to start from the Fourier series representing the mmf. distribution due to a single coil and to build up from this series the corresponding series for any complete winding. The effect of the value of the coil span is discussed and data relating to the various winding factors concerned are given in a simple graphical form applicable to the harmonics of any order whether odd or even. The resulting mmf. due to a number of coils carrying the same current is then deduced from the effect of a single coil. It is shown that all types of polyphase windings fall into one category, the treatment being general and directly applicable to all types of windings whether normal polyphase, full-pitch or chorded, or a winding intended for pole changing.—*Journal of the Institution of Electrical Engineers (England)*, July, 1923.

Valve Tubes Containing Rare Gases.—F. SCHRÖTER.—The value or rectifying action of neon or helium tubes containing metallic electrodes of widely different size is being exploited now commercially for a number of purposes. As a rectifier from alternating current to direct current to charge small batteries such a simple and inexpensive tube may be used for currents not exceeding about 0.4 amp. and voltages of between 100 and 250. Using a single tube gives an efficiency of about 50 per cent, which can be increased to more than 60 per cent if four tubes are connected in a bridge. Another promising field for these tubes is their use as a voltage reducer to operate, for example, doorbells or telephone circuits from a 110-volt house circuit instead of bell ringing transformers or dry cells. The tube reducer operates on either direct or alternating current. These tubes may also be used as effective overvoltage protectors. Up to a certain critical voltage the tube acts as an insulator, barring all passage of current, but beyond this tension the rare gas turns quickly into a good conductor, carrying the overvoltage to ground. Particularly on telegraph and telephone lines, these tubes have proved very useful as overvoltage protective devices. Tests showed that such a tube withstood safely 10,000 overvoltage punctures. Below their critical voltage the tubes have an internal resistance of about 1 megohm.—*Elektrotechnik und Maschinenbau*, July 22, 1923.

Traction

Developments of the Motor Coach.—C. E. BROOKS.—The renewed interest taken in this type of equipment and the reasons why railway officials have been forced to turn to it are discussed. Advantages and disadvantages of the various types of gasoline-engine, storage-battery, steam and gas-electric cars, with performance data for each type, are considered.—*Mechanical Engineering*, August, 1923.

Application of Storage-Battery Locomotives to Mining.—E. J. GEALY.—The author outlines the advantages and reasons for increased application of this type of locomotive to the mining industry. The storage-battery locomotive should be simple in construction, rugged and, above all, efficient. Sparkless commutation, great overload capacity and maximum torque per ampere are also important factors in the motor design. Other pertinent facts regarding the locomotive are discussed. The article concludes with a simple method for calculating battery capacity.—*Coal Age*, July 26, 1923.

Unified Transportation System for Chicago.—Details are given of the Kelker report just given to the City Council of Chicago to show possible extensions to the rapid-transit surface lines throughout the city. The time for carrying out the plan is divided into two periods in order to reap its benefits sooner. Time savings in all parts of the city are shown.—*Electric Railway Journal*, Aug. 4, 1923.

Telegraphy, Telephony, Radio and Signals

Directional Wireless Telegraphy in Aircraft.—C. K. CHANDLER.—The author deals with the operation of directional wireless telegraphy in aircraft where the directional aërials are installed in the aircraft. Curves are given showing the errors obtained, and formulas are developed showing the factors on which the errors depend. Methods of predicting and correcting the errors are given. Curves of variation in bearings of transmitting stations are given and discussed.—*Journal of Institution of Electrical Engineers (England)*, July, 1923.

Signal-to-Static-Interference Ratio in Radio Telephony.—J. R. CARSON.—Several general propositions are stated relative to the signal-to-static ratio, in single and double side-band transmission, indicating a superiority in practice for the former system.—*Proceedings of Institute of Radio Engineers*, June, 1923.

Progress in Automatic Telephony.—An example of the installation of an automatic telephone system for city service in England is described. The Siemens system is installed. Among the subjects discussed are the preselector, general operation, installation details, link distributing frame, power source and motor interrupter racks.—*Electrician (England)*, July 13, 1923.

Induction on the Communication Line Caused by Parallel Power Lines.—S. KUDO and S. BEKKU.—To prevent the dangerous voltage induced on the telephone and telegraph lines by accidental grounding of the power transmission line, high resistances are used in Japan for the connection of the neutral of the power system to the earth. Oscillographic experiments on communication lines were performed by the authors and are shown and explained. Virtually no danger will be produced on the communication line by the insertion of high resistance between the neutral and the earth.—*Researches of Electrotechnical Laboratory, Tokyo, Japan*, No. 121.

Miscellaneous

Construction of Concrete Fuel-Oil Tanks.—Concrete tanks are recommended for the storage of fuel oil when the specific gravity of the liquid is heavier than 35 deg. Baumé at 60 deg. F., but should not be ordinarily used for lighter oils. This paper was originally presented at the annual meeting of the American Concrete Institute. The following subjects are considered: design of tanks, concrete specifications, proportions and mixing of concrete, construction forms and details of construction.—*Canadian Engineer*, July 10, 1923.

Heat Utilization in Power Plants.—A. R. SMITH.—In this article, the fourth and concluding one of a series, the author discusses the utilization of heat in steam-electric power plants, dealing in great detail with the heating of air for combustion and with other features of heat utilization. He discusses the heating of feed water by fuel economizers, exhaust steam from steam-driven auxiliaries and extraction of steam from the main turbine. He points out that the same means may be utilized for the heating of the air in boiler furnaces with almost equal advantages.—*General Electric Review*, August, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Broadcasting Over Wires

Demonstration of Squier's System Made on Staten Island — Commercial Application Follows

DURING the last eighteen months the North American Company, through its subsidiary, Wired Radio, Inc., has been experimenting with a system of wired-radio "broadcasting" over electric lighting and power lines, under the basic patents of Major-General G. O. Squier. General Squier has granted an exclusive license to Wired Radio, Inc., for this purpose, and the system is being developed in co-operation with a number of large lighting and power companies. No transmitting or receiving aërials are used; instead, the sending apparatus is connected to one phase of the three-phase buses at the power house and the radio waves follow along the wires to the receiver, which is plugged into any electric lamp socket or convenience outlet in the home, just as an electric fan, iron or toaster is connected.

New types of simplified transmitting and receiving apparatus have been developed. One of the receivers is a combined tuner-amplifier and "loud speaker" in a small cabinet. Current for lighting the filaments is supplied from the 110-volt lighting mains through an ordinary lamp-cord connection which also carries the radio waves into the receiver, where they are amplified and converted into voice and music. No antenna, ground connection, storage battery or special wiring is required, and any number of receivers may be operated simultaneously in a home or apartment house without interference. An adjustment permits reception of the ordinary space-radio programs.

In co-operation with the Richmond Light & Railroad Company, which supplies electric lighting and power service to about 25,000 consumers on Staten Island, New York City, the first commercial wired-radio plant has been installed. The Wired Radio Service Company has been organized to conduct commercial operations and has been granted exclusive license for the local territory. Regular service on a 6,800-m. wave length will begin early in September. Receivers will be rented and the monthly charge will also cover cost of the program service. The rates are $2 monthly for a head telephone set, $3.50 for a small loud speaker and $5 for a large loud speaker.

A demonstration of the system was made on Aug. 29, and representatives of the press were much impressed by it. Simply by plugging into a convenience outlet in any of the wired homes on the island, the radio was received clearly and loudly.

A wired-radio program of a comprehensive kind is to be furnished which will be continuous from early morning until late at night. Later on the company expects to offer more than one program on various wave lengths, and tuning dials are provided on the receiving sets for this purpose.

C. W. Hough is president and R. D. Duncan, Jr., is chief radio engineer of Wired Radio, Inc., and J. Arch Mears is president of the Wired Radio Service Company.

Europe Is Now Showing America the Way

Owen D. Young in an Interview Cites the Present Progress of Water-Power Development and Railway Electrification Abroad as an Example We Should Heed

O. D. YOUNG

OWEN D. YOUNG, chairman of the board of the General Electric Company and of the Radio Corporation of America, lately returned from an extended trip abroad, has brought with him a deep impression that Europe is setting America an example today in the appreciation of electric power. In discussing the situation with a representative of the ELECTRICAL WORLD Mr. Young said:

"The present interest of the nations of Europe in the development of water power should have a particular significance for the electrical industry and the people of America. The water powers of Europe are being developed because the people of those war-torn nations cannot afford to be wasteful. This is the literal truth. For the economic pressure upon France, England, Italy and Germany is so intense that men's minds are impelled to seek ways and means of getting work done in less costly ways. In Italy and France, notwithstanding the financial stress, the development of water power is actively under way, and it is a recognized national policy that this great national resource shall be developed to contribute what it may toward relieving the difficulties under which the people are laboring. They recognize that water power is a source of public wealth which may be appropriated at this time for public relief, and they are devoting their energies to carrying out these projects in the belief that no matter how difficult it is to finance public works, the effort is justified by the need.

"What a contrast it is that America, a nation rich beyond comparison in history and with a wealth of national resources that staggers the imagination, should be content to let her water powers run to waste! The general increase in the cost of living has brought a universal demand for such economies and efficiencies as may be introduced into our scheme of living to reduce the burden on the people. Vast national projects for water-power development have been worked out in detail, planned to help in relieving the situation. Not only the electrical industry but the business men of the country and the men of government all frankly recognize, as a matter of theory, that our enormous water-power resources should be developed and applied in the public interest. Yet small progress is being made, that is, in proportion to the opportunities. We in this country have long been conscious of the importance of water-power development from an economic point of view, but as a nation have never really bestirred ourselves to make it a reality. Meanwhile, Europe, poor beyond comparison, has the courage to go ahead."

RAILWAY ELECTRIFICATION ALSO

Mr. Young was also particularly interested in the fact that under the impulse of necessity European nations are also forging ahead in the matter of railway electrification. "More rail-

way electrification is in process and in prospect in Europe today," he said, "than in the United States."

"Again we see stranded Europe going ahead," he continued, "and we, rich beyond measure, are willing to waste from 12 to 14 per cent of the capacity of our railroads in hauling coal to make their own power. It would seem that America is suffering from the weakening influence of its own great resources, while Europe, like the poor man who works hard because he must, is concentrating her strength on practical measures of economy that seem to offer her, through saving, profits with which she may restore her economic health."

Mr. Young expressed the belief that public opinion in Europe is becoming steadily more opposed to municipal operation of national resources and public utilities. "The rigid machinery of government," he said, "has nowhere proved an efficient agency for development, and Europe is beginning to appreciate this just as we do in America. The suddenly increasing need for private capital in the development of the water-power resources and the expansion and rehabilitation of other systems will tend to accentuate the importance of permitting the improvement of utility services under a liberal policy of public regulation."

THE GENERAL OUTLOOK ABROAD

Mr. Young expressed himself as decidedly encouraged over the general business outlook in Europe. While from a political standpoint the restoration of harmony among the nations of the Old World seems to be slow, business men are individually re-establishing business relationship and through contact and co-operation are building up anew a basis on which the work of the world may be done. Ultimately this will make it easier to clean up the political situation also. The electrical business in Europe appears to be very good at present, Mr. Young asserted. This is a natural result of the activity in the development of water-power resources, for to market this raw material brings a natural demand for all kinds of electrical manufactures. The domestic demand in all the nations of Europe seems to be strong, and, all in all, the industry is confident and making progress.

Electricity Aids Cincinnati's Fall Festival

To electrical activities of a varied character is due a large measure of the success of the million-dollar Fall Festival and Industrial Exposition now being held in Cincinnati, which opened on Aug. 25 and will close on Sept. 8, the halls and grounds covering ten city blocks. The principal inside attraction is the "Electrical Palace" in the south wing of Music Hall, where more than a hundred electrical exhibits are on display or in operation. Here the decorations, which give a picture of old China, are on an imposing scale.

The Electric Club of Cincinnati has taken an important part in the development of the plans, and its president, M. A. Curran, announces that there are 25 per cent more electrical exhibitors than in any previous affair of the kind held in that city.

In Washington Park, in the exhibition grounds, is the tower of jewels designed especially for the exposition by W. D'A. Ryan, director of the General Electric Company's illuminating engineering laboratory. The towers, which stand 90 ft. high and contain 5,000 miniature lights mounted on twenty standards, were illustrated in the ELECTRICAL WORLD for Aug. 4, page 245. They cost $50,000, and the rays from forty 18-in. searchlamps thrown upon the spectacle make it visible for many miles.

The president of the Cincinnati exposition is Warner Sayers, secretary and treasurer of the F. D. Lawrence Electric Company.

Dinner in Honor of F. R. Low, Editor of "Power"

For thirty-five years Fred R. Low has directed the editorial policies of *Power*, and in commemoration of this notable achievement and as a tribute to Mr. Low as an editor, engineer and friend a dinner was held in his honor at the Engineers' Club, New York City, Aug. 29. The chief editors of all the McGraw-Hill publications, the staff of *Power*, Martin Foss of the McGraw-Hill Book Company, Calvin W. Rice, secretary of the American Society of Mechanical Engineers; H. M. Swetland and James H. McGraw, president of the McGraw-Hill Company, attended the dinner and tendered their felicitations to Mr. Low. Mason Britton, vice-president of the McGraw-Hill Company, was toastmaster and introduced the speakers of the evening, Frank Wight of the *Engineering News-Record*, H. M. Swetland, president Class Journal Company; James H. McGraw, Calvin W. Rice and Jay Mason.

A silver cup was presented to Mr. Low by Mr. Mason on behalf of those present as a token of their appreciation of his accomplishments. Mr. Low in his response insisted on the credit due to his associates for their aid in making *Power* a great paper. Mr. McGraw paid tribute to Mr. Low as one of the half dozen great engineering editors this country has known and outlined the qualities of vision, courage and knowledge which have contributed to his success. Mr. Rice dwelt on Mr. Low's unselfish and unceasing work in the A. S. M. E. and told how he had gained the respect and affection of all his professional associates. Mr. Wight accented the position held by Mr. Low in the hearts and minds of his fellow-editors and gave expression to the warm feeling they entertain for their "dean." All joined in wishing Mr. Low a long and happy future in guiding *Power* to new achievements.

F. A. E. S. Coal-Storage Committee Meets in Chicago

Means whereby large industrial establishments may start a policy of storing large quantities of coal during the slack summer months were discussed in Chicago on Monday and Tuesday at a conference of the coal-storage committee of the Federated American Engineering Societies. This committee met in the office of its chairman, W. L. Abbott, chief operating engineer of the Commonwealth Edison Company. The final report of the committee will probably go to the Federal Coal Commission about Dec. 1 for publication on Feb. 1. Much study has been devoted to the subject of a base line of coal production and the consumption curve. The solution of one phase of the coal problem is thought by the committee to lie in the storage of fuel. This storage should be made in the summer months when coal is easily mined and distributed by both rail and water.

In refuting the contention that coal in storage disintegrates and deteriorates Dean S. W. Parr of the University of Illinois told of his twelve years of experimenting with coal at Urbana. He thought that the question was not so much a matter of finding storage space as of educating those who should store it in the proper methods of handling the fuel with little loss in heat units. Reports were presented by W. J. Jenkins, vice-president Consolidated Coal Company, on mine storage; E. S. Nethercut, secretary Western Society of Engineers, on the development of storage possibilities in Chicago; R. V. Norris, consulting engineer, on anthracite storage; R. F. Walker, dean of the School of Engineering, University of Kansas, and O. P. Hood, chief engineer United States Bureau of Mines.

Program of Bedford Springs Convention

Among the features of the convention of the Pennsylvania Electric Association to be held at Bedford Springs, Pa., on Sept. 5-8, in addition to reports from the various committees of the Technical, Commercial and Public Relations Sections, will be addresses by W. H. Johnson, president National Electric Light Association; E. A. Hirschman, secretary York (Pa.) Chamber of Commerce; J. S. S. Richardson, director Pennsylvania Public Service Information Committee, and by W. D. B. Ainey, chairman; Herbert Snow, chief engineer, and G. S. Call, chief of Bureau of Statistics and Accounts, of the Pennsylvania Public Service Commission.

At the commercial session on Friday these papers will be presented: "New-Business Policies with Special Reference to the Wiring of Old Houses," by M. C. Huse, Philadelphia Electric Company; "Rural Lines," by W. H. Horton, Jr., West Penn Power Company; "Store Lighting," by N. E. Underwood, National Lamp Works.

Outline of Michigan Association Program

With the electrical industry of Michigan pushing an expansion program in excess of $25,000,000, the greatest in its history, the annual convention of the Michigan Electric Light Association, to be held at Grand Rapids on Sept. 18-20, assumes greater importance than ever before. The training of metermen will be reviewed by Prof. Benjamin F. Bailey, head of the department of electrical engineering, University of Michigan, who will tell of the work at the meter school. Rural-line extensions will be discussed by G. C. Neff of Madison, Wis., and J. C. Martin of Chicago. M. K. Toeppen, engineer of the Public Utilities Commission, will deal with questions which have been raised about the standards of service put into effect by the commission. R. C. Longhead, chief engineer of the Michigan Inspection Bureau, will discuss "Wiring on Customers' Premises"; B. L. Huff, distribution engineer for the Consumers' Power Company, Jackson, will talk on "Overhead-Line Construction"; the advisability of forming an electrical league in Michigan will be presented by C. J. Litscher of Grand Rapids, and George Opp, safety engineer for the Detroit Edison Company, will deal with accident prevention and demonstrate the prone-pressure method of resuscitation.

Laguna Bell 220-Kv. Substation Placed in Service

The new Laguna Bell 220,000-volt outdoor receiving substation of the Southern California Edison Company, described in the ELECTRICAL WORLD for March 31, page 766, was placed in active service on Aug. 2. The station is a short distance southwest of Los Angeles in the center of the company's industrial load. All equipment is out of doors, on a plot of ground about 350 ft. wide and 600 ft. long, with the exception of a 30,000-kva. synchronous condenser and the switchboards for operating the station. Both of the Big Creek transmission lines, which were placed in operation at 220,000 volts on May 6 last, have been extended from the original terminus at Eagle Rock substation to Laguna Bell, a distance of 30 miles. Two banks of 220,000/60,000-volt transformers, each having a bank capacity of 60,000 kva., feed into a 60,000-volt bus, from which there are in all thirteen 60,000-volt outgoing feeders.

The Laguna Bell substation is unique in that it is the first 220,000-volt substation to be placed in service and because of the unusual type of bus construction. The bus consists of 4-in. iron pipe mounted on pillar insulator posts set on concrete pedestals with no overhead steel structure. The Laguna Bell station was completed at a cost of approximately a million dollars and will serve as an important distribution point for power from the Big Creek plants and for the rapidly growing industrial load in the vicinity of Los Angeles.

Milan R. Bump Made Chairman of Joint Committee

Meetings of executive and other committees of the various sections of the National Electric Light Association were held at the New York headquarters, beginning Friday, Aug. 24, and continuing through this week. Among the most important of the meetings was that of the Joint Committee for Business Development on Thursday, presided over by Chairman E. W. Lloyd and devoted to the discussion of reports covering the year's work.

S. M. Kennedy, vice-president of the Southern California Edison Company, recommended to the committee a serious study of the problem of local merchandising. He related in detail the experience of the Los Angeles central-station company in discontinuing some years ago the sale of household appliances in the interest of local contractors and dealers. The expectation that this would spur this branch of the industry to greater activity in merchandising has been disappointed. This year from 35,000 to 40,000 residential consumers will be added to the lines of the Southern California Edison Company, forming a large potential market for appliances, but nobody is going after them. The problem thus created is of serious importance to the industry, Mr. Kennedy said, and a generally approved policy concerning the proper position of the central station in marketing these devices must some day be determined.

Owing to the inability of Mr. Lloyd to give the time necessary to the discharge of the chairman's duties, the nominating committee named for that office Milan R. Bump, in whose administration as president of the N. E. L. A. the Joint Committee was launched, and he was unanimously elected.

Commission Will Hear Louisville Again

Execution of Permit to Hydro-Electric Company Delayed Till Sept. 6—Power and Pulp Project in Alaska Favored—Contest Over 125,000-Hp. Development on New River

A LETTER has been received by the Federal Power Commission from the Mayor of Louisville, Ky., expressing surprise that action had been taken by the commission in the conflicting applications for a permit to develop power at the proposed government dam at the Falls of the Ohio near that city without opportunity having been given to hear more from the municipality. Inasmuch as the Louisville Hydro-Electric Company did not promptly accept its preliminary permit, opportunity for delay was given. The Mayor has been informed by the commission that it will hold up execution of the preliminary permit until Sept. 6 to afford opportunity for the municipality to make a further showing.

ALASKAN PROJECTS

The Forest Service has sold a large block of timber in the Cascade Creek region of Alaska to the highest bidders, who were Hutton, McNear & Dougherty. This firm holds a permit from the Federal Power Commission for a pulp and power project on Cascade Creek, which proposes an ultimate development of approximately 30,000 hp. and is one of the largest and best power projects in Alaska. Application for a license has been before the commission about seven months, action having been withheld pending completion of the sale of the timber. There is now nothing to delay the granting of the license, and it is anticipated that this action will be taken at the next meeting of the commission.

Another power project in Alaska which promises to go through is that of the Alaska Mineral Development Company on Bradford Canal. This company is affiliated with the Guggenheim interests. The project as originally planned, however, conflicted with the plans for the preservation of fish, and the permittee is applying to the commission for an extension for one year to enable it to complete modified plans which will be satisfactory to the Bureau of Fisheries of the Department of Commerce. The extension probably will be granted.

CONFLICT OVER NEW RIVER

The Federal Power Commission has written to the Appalachian Power Company and the Norfolk & Western and Chesapeake & Ohio railroads, which entered protests against granting the application of the West Virginia Power Company, a subsidiary of the Virginian Power Company of Charleston, that the engineering staff proposes to recommend granting the application to the West Virginia company for its proposed project on New River. The application was protested on the ground that the development would drown out the Appalachian's proposed Anderson Falls project and would put 20 ft. of backwater on the Glen Lyn steam plant of the Appalachian company and that the railroad beds would be flooded by the proposed reservoir. The commission's engineering staff takes the position that the project of the West Virginia company is more comprehensive and better than the Anderson Falls project and that the question of damages from backwater effect is one to be settled when the detailed surveys have been carried out. The project of the West Virginia

Power Company contemplates an estimated development of 125,000 hp.

The Governor of Arizona has written the commission asking that a date be fixed for a conference with a committee from Arizona to go over the Girand application and the general question of development of the Colorado River. As this would open a new phase in the effort to bring about a compact between the states concerned in developing the Colorado River, much interest attaches to the move.

Hydro-Electric Development in the Maritime Provinces

Work is progressing favorably on the Malay Falls development on the East River at Sheet Harbor, near Halifax, Nova Scotia, according to United States Consul-General Gunsauls. The initial installation of 5,600,000 kw.-hr. a year is being increased to 8,000,000 kw.-hr. The towns of New Glasgow and Trenton, which are to be supplied from this development, have voted for public ownership of their distribution systems. Stellarton is also to be served and will probably also vote for public ownership. Investigations have been made by the Nova Scotia Power Commission of plans for supplying the town of Truro with electrical power. The town of Amherst and neighboring places are considering entering into a contract for power from the Economy River in Cumberland County.

In New Brunswick the proposal that the province begin development of the Grand Falls of the St. John River, perhaps the largest cataract in inhabited territory east of the Niagara Falls, is being constantly urged. The town of Campbellton, faced with the necessity of soon enlarging its steam generating plant, is pressing actively for the production of hydro-electricity. The provincial government has at its command a million dollars for beginning work on the development if it decides to do so before the next session of the Legislature. The Premier of the province is known to be taking an active interest in the project, but his plans have not yet been announced.

New Atlantic Cable Landed at Far Rockaway, N. Y.

The American end of the new Atlantic cable of the Commercial Cable Company was successfully landed at Far Rockaway, N. Y., this week for connection with the cable station there. A heavy surf caused some difficulty and delay, one of the ropes used to haul the cable from the buoy to which it had been attached a few hundred feet from shore breaking under the strain. The other end of this section of the cable will be landed at Canso, Nova Scotia. From there the cable will be laid to the Azores Islands, connection thence being made with Waterville, Ireland, and from there with London. A new cable from the Azores to Havre, France, will be in place by the end of the year. This is the first Atlantic cable laid since 1910, and it will give the Commercial Cable Company its sixth transatlantic circuit. The total cost exceeds $15,000,000. The new cable will be the longest and fastest between America and Europe. It will have a capacity of 1,200 letters a minute—600 in each direction.

Prof. Michael I. Pupin of Columbia University, who is consulting engineer for the Mackay companies, made a short talk to guests of President Clarence H. Mackay who assembled at Far Rockaway about the comparative values of the radio and cable in the development of international communication systems. "The cable," said Professor Pupin, "will be the great carrier of business transactions in the future. The radio will in no way interfere with it, as it will not be so fast and will not be so trustworthy. The cable is the working tool of business. It transmits clearly and accurately the message, which is of particular service to business. It works whether there is a storm at sea or on land. Nothing short of an earthquake or a great electrical disturbance can break in on its performance, and that only for a short time."

Utility Financing Dull During August

ELECTRIC light and power utility issues to the amount of $48,507,800 were offered during the month of August. This figure denotes relatively light financing in comparison with the large amounts offered in the earlier months of the year, but compares favorably with July, when the total reached was only $23,080,000. The offerings were small in number—thirteen—but the two ten-million-dollar issues, the Cleveland Electric Illuminating Company's preferred stock, series of 1923, offered at par, and the Milwaukee 6 per cent gold bonds, helped to swell the volume. The average yield dropped from 6.58 in July to 6.30. Seven of the offerings represent applications for strictly new capital, two are for refunding purposes and four are for both refunding and capital expenditures.

Undoubtedly the security market is dull, but this seasonal slump is a normal condition. It is reported in financial circles that some large public utility issues are in prospect but that they are being held back pending a more active interest in the investment security market upon the close of the vacation period. That the electric light and power industry is at present enjoying a period of sound prosperity is evidenced by the fact that reports covering the total output of the central stations of the country for six months ended in June indicate an increase of 25 per cent over the same period last year.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN AUGUST

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Cleveland Electric Illuminating Co.	$10,000,000	..	Cumulative not-voting preferred stock, series 1923	Additions and refunding	6	100	6
Ottawa & Hull Power Co. (Ont.)	1,500,000	..	Cumulative preferred stock	Additions	7	99*	.....
Danbury & Bethel Gas & Electric Light Co. (Conn.)	600,000	25	Mortgage gold bonds, series A	Additions	6	100	6
North American Edison Co. (N. Y.)	8,000,000	25	Secured sinking-fund gold bonds, series B	Refunding	6½	98½	6.63
Oklahoma Gas & Electric Co.	2,100,000	3	Mortgage notes	Refunding and acquisition of control of another property	7	98½	7.50
Alabama Power Co.	3,000,000	28	First mortgage lien and refunding gold bonds	Additions and extensions	6	99	6.07
Central Connecticut Power & Light Co.	300,000	5	Gold coupon notes	Construction and acquisition of stock	7	100	7
Dallas Power & Light Co.	1,000,000	26	First mortgage gold bonds, series A	Additions and extensions	6	100	6
Los Angeles Gas & Electric Corp.	4,000,000	19	General and refunding mortgage gold bonds, series G	Additions	6	99½	6.05
Ottawa Light, Heat & Power Co. (Ont.)	1,500,000	..	Cumulative preferred stock	Refunding	6½	100	6.50
Staten Island Edison Corp. (N. Y.)	3,807,800	30	Refunding and improvement mortgage gold bonds	To retire floating indebtedness and acquire $700,000 par value of underlying bonds	6½	99	6.60
Indiana Electric Corp.	2,700,000	30	First mortgage gold bonds, series B	Construction	6½	99	6.57
Milwaukee Electric Railway & Light Co. (Wis.)	10,000,000	30	Refunding and first mortgage gold bonds, series C	Refunding and to reimburse for additions	6	98½	6.10
Total	$48,507,800						

* Carrying a bonus of 25 per cent common stock.

Seattle's New Substation

lectrical Apparatus for the Receiving End of Skagit River System Under Order

WITH its Skagit River development well under way, the city of Seattle has begun the erection of a large substation, known as the North substation, to serve as the receiving end in the city for the development. The new station will be in a residential district and is designed to harmonize with its surroundings. There will eventually be installed in it a maximum of six banks of transformers with the necessary synchronous condensers and switching equipment.

The initial installation will include the equipment for one incoming transmission line at 154,000 volts, one transformer bank and one 15,000-kva. synchronous condenser. An order for this apparatus has been placed with the Westinghouse Electric & Manufacturing Company and it is now in course of construction. An electrostatic glow meter will be used for synchronizing on the 154,000-volt side. The stepdown transformer bank has three 10,000-kva. transformers with tertiary windings. Both the 154,000-volt and 26,000-volt lines are connected with permanently grounded neutrals. The 26,000-volt side is connected to a bus section on which there are three feeders. In the future each transformer bank will have a 26,000-volt bus section, all the sections to be tied together through reactors. At the present time two sections with a total of six feeders will be tied together without reactors and will be fed from the one transformer bank. The tertiary windings of the transformers are connected in delta at 6,300 volts and are connected to the 15,000-kva. synchronous condenser wound normally at 6,600 volts. Taps are brought out of the transformers for starting the condenser.

The high-tension oil circuit breakers are type G-2 400-amp., 154,000-volt; the 26,000-volt breakers are type CO-2, 1,200 amp., with mufflers, and the breakers for use with the 6,600-volt condenser are type CO-11, 1,600 amp., 25,000-volt. The auxiliary equipment consists of a 300-kva. transformer bank, a 100-kw. motor-generator set to be used for an extra exciter, for operating a crane or for charging the storage battery in an emergency; a 7½-kw. battery-charging set, and a sixty-cell storage battery for control purposes.

A type D-3 benchboard having a relay board in the rear with grill work at each end will be supplied. This desk will be used for controlling the condenser and the incoming line and is drilled for future apparatus for controlling the second line and the tie breaker between the lines. Two switchboards back to back with grill work between will be provided for controlling the 26,000-volt feeders and the voltage regulator equipment for the condenser.

There will also be a temperature-indicating board for indicating the temperature of the coils in the condensers and the temperatures in the individual transformers; a station service board for controlling the storage battery, station light and power, a spare motor-generator set and other miscellaneous circuits; a field control board, and a crane panel. Differential protection will be provided for the condenser and for the entire transformer bank. The 154,000-volt incoming line will be protected with type CR relays and a ground relay.

Acquisition of Superior (Wis.) Plant by City Halted

Efforts by the city of Superior, Wis., to acquire the property of the Superior Water, Light & Power Company (see ELECTRICAL WORLD, March 31, page 766) received a setback last week when the United States District Court handed down a decision denying the city's motion to dismiss the injunction proceedings started by the attorneys for the utility permanently to restrain the city and Railroad Commission from further action. Under this ruling the proceedings for the acquisition of the utility properties have been halted, though the case will still be in the courts for some time.

In denying the motion to dismiss the injunction proceedings the court said:

"It is an elementary rule of the law of eminent domain, and the proceedings in question are undoubtedly of that nature, that before title to property condemned may pass compensation must be paid or tendered. Where the state or municipality condemns, this rule is relaxed on the theory that the state or municipality is obligated to pay and all the taxable property therein is pledged to secure the former owner his compensation and he is thus sufficiently secured. But in this case, according to the bill, the city could not obligate itself nor be obligated to pay the compensation found. Hence the reason underlying the relaxation of the general rule is wanting and it seems clear that the general rule ought to apply. Clearly the uncertain result of the future issuance and attempted sale of bonds under the provisions of the Nye law does not afford to complainant that present security to which it is entitled for present taking of its property. Quite certainly the bill presents on its face a case where the due process clause of the Fourteenth Amendment to the federal Constitution is violated."

In reply to a petition to make this injunction permanent the city admits that on March 19, 1923, its financial condition was not such as would warrant the floating of a bond issue for the purchase of the properties in issue, but maintains that the city is at the present time "fully able to obtain sufficient funds to pay the amount of compensation which the Railroad Commission might fix on the plants" and that the city was able to do so at the time the award was made, on July 11, 1921.

Scramble for Wave Lengths

Communications Expert Tells Political Institute of Worldwide Contest Over Radio

SPEAKING before the annual political institute held at Williamstown, Mass., under the auspices of Williams College, which is participated in by well-known men of Europe as well as America, Walter S. Rogers, communications expert for the United States at Versailles, declared that private radio companies and numerous foreign governments are engaged in a general "scramble" for future monopoly of particular radio routes and wave lengths. The problem of priority rights, he said, has arisen in international as well as in domestic transmission by radio and presents a situation full of complexity.

"The problem that particularly confronts the United States is in reference to the wave lengths that are usable for transoceanic communication," Mr. Rogers asserted. "The number of wave lengths available for such communication is relatively limited, and in truth there is a scramble going on as between private companies and governments for obtaining, or rather making use of, as many wave lengths as possible, so that when this problem reaches the state of serious international consideration people can go in and assert that they have already established basic rights.

"Just as here in the United States we have not worked out legislation to determine the ownership of wave lengths, so internationally there is no agreement between the powers as to ownership of wave lengths employed in international communication. A conference was held in Washington in the fall and winter of 1919 and 1920 to deal with the subject, and one of the serious problems was the question as to who ultimately owns the right to use space for communication purposes. The delegates from the five powers that participated in the conference worked on the theory that the governments taken together held this ultimate right and that they might get together and allocate the various wave lengths for particular purposes and as between themselves for special services.

PRIVATE AND PUBLIC INTERESTS

"The private radio interests throughout the world fought the conception, because there is no question that certain private radio companies believed that by something analogous to what we call 'squatter's' rights they could obtain an actual out-and-out ownership of the right to use wave lengths. They do not want to get the right to use wave lengths through a license from any government or as a result of any international agreement. They want simply to acquire these rights complete. We cannot foresee the possible development of the transmission of energy through space, and really great stakes are being gambled for."

Brief News Notes

Kansas City Company Supplies Power for Fish Hatchery.—The Kansas City Power & Light Company has just completed a transmission line to supply electric service at the fish hatchery now in process of construction in Swope Park. The water used in this hatchery will be taken from the Blue River by an electrically driven centrifugal pump with a capacity of 1,000 gal. per minute.

McGraw-Hill Editors to Give Radio Talks.—The first of four radio talks to be given by editors of the McGraw-Hill Company publications in September will be made on Wednesday night, Sept. 5, by Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD. Mr. Whitehorne's subject will be "Who Has More Slaves than Pharaoh?—A Talk on Electricity."

"Institute News" Makes Its Appearance at Madison.—The *Institute News*, published by the Institute for Research in Land Economics and Public Utilities, of which Dr. Richard T. Ely is director, is being issued from the headquarters of that organization at Madison, Wis., to further the research which is indicated in the name of the body. Benjamin F. Wigder is editor.

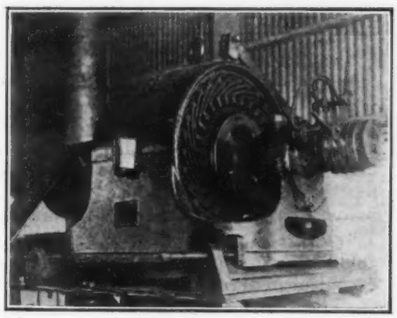
The Tombigbee as a Power Site.—Engineers of the State of Mississippi, after a superficial survey of the Tombigbee River in the vicinity of Columbus, assert that an ideal site for water-power development on the stream exists 3 miles north of that city at Plymouth Bluff. The engineers are so impressed with the site and its natural advantages that they have decided to make a minute and complete survey of the site.

Massachusetts Public Utility Law Compilation.—A compilation of the laws of Massachusetts relating to electric and gas companies is being published in a limited edition by Allan Brooks, assistant secretary of the Department of Public Utilities, State House, Boston. The compilation includes the law relating to the department's organization, duties and functions and includes various amendments to public utility statutes, including those passed at the 1923 legislative session.

Des Quinze Power Company Building Line to Porcupine Gold Mines.—The Des Quinze Power Company, a subsidiary of the Northern Canada Power Company, which is developing 20,000 hp. on the Quinze River, Quebec, has appropriated $1,500,000 for the construction of a transmission line from its power plant to the Porcupine gold fields, 125 miles distant. This line will, it is hoped, be completed by next March.

Asheville Light & Power Purchases North Carolina Electrical Power.—At a price understood to be $500,000, the Asheville (N. C.) Light & Power Company has purchased the properties of the North Carolina Electrical Power Company, also of Asheville, these properties including electric generating stations at Marshall, Big Ivy, Craggy and Owenby. Improvement and extensions are contemplated.

A Veteran Westinghouse Motor.—After twenty-seven consecutive years of service in the Sacramento shop of the Atchison, Topeka & Santa Fé Railroad a 15-hp. motor manufactured by the Westinghouse Electric & Manufacturing Company still stands up to its daily task. The machine, which is a Westinghouse Tesla type B alternating-current induction motor, with a rating of 1,200 revolutions per minute, three-phase, 60 cycles, 500 volts, was installed in 1896, only two years after this type of motor was developed. It has a rotating primary and a stationary secondary provided with a series of U-shaped resistance grids bolted to the rear ends



of the secondary bars for starting duty. When the motor is up to speed the secondary is short-circuited by moving the large lever at the top of the motor frame, which is connected to the large copper ring visible inside at the top of the frame. This ring mounts a number of fingers which make contact with the square bosses at the upper ends of the cross-connections.

Two More Oklahoma Municipal Plants Give Up.—The citizens of Cement and Minco, Okla., have voted to sell their municipal electric plants and grant twenty-five-year franchises to the Chickasha Gas & Electric Company. The vote in Minco was 132 to 17 and in Cement 143 to 10. The company will pump the city water and light the streets in both towns. The present plants will be closed down and service will be supplied from transmission lines.

A 60,000-Hp. Utah Project.—Supplementary to several irrigation filings made by A. H. Christensen of Salt Lake City is one for the storage of 150,000 acre-feet of water from an unnamed branch of Ferrom Creek, in Emery County, with which he expects to develop 60,000 hp. of electrical energy. The application is somewhat lacking in details, but the length of the diversion canal is given as 428,260 ft., slightly over 80 miles. Two power plants are proposed, one in Oak Creek, which will operate under a head of 2,100 ft., and one in Salt Creek Canyon, to operate under a head of 900 ft.

Byllesby Buys River Falls Power Company.—The River Falls Power Company, owning and operating electric light and power properties in Prescott, Wis., and Hastings, Minn., has been acquired by H. M. Byllesby & Company and will be consolidated with the Northern States Power Company system. This company has been serving a combined population of six thousand in the two places. They formerly were supplied with electrical energy by the Northern States Power Company on a wholesale basis.

Development of St. Francis River, Quebec.—Construction work on the Hemmings Falls development of the Southern Canada Power Company is about to be undertaken by the Foundation Company Limited of Canada. It is intended to develop 30,000 hp. at this site. The plant will be the second in a chain of six to be developed by the Southern Canada Power Company on the St. Francis River, to have an estimated aggregate capacity of 150,000 hp. More than half the rated output of the Hemmings Falls plant has already been sold, and it is thought possible that its entire capacity will be disposed of before operation begins.

Development of Hiwassee River.—Engineers of the North Carolina Geological and Economical Survey have just begun a complete survey of the Hiwassee River and its tributaries in order to obtain detailed information as to the storage possibilities of the river and work out a comprehensive plan for its development. As soon as these field data are collected they will be compiled and a comprehensive report along with plans for development of the river published. It is estimated that the section of the river in Cherokee and Clay Counties, N. C., is capable of developing 500,000 hp. of electrical energy. It is therefore one of the largest undeveloped streams in that section of the country.

A. B. Stickney Wins Westinghouse Turbine Design Prize.—The prize of $500 offered by the Westinghouse Electric & Manufacturing Company to the senior mechanical engineering student at the Sheffield Scientific School of Yale University producing the best turbine design along a combined impulse and reaction principle has been awarded to Alpheus B. Stickney II, St. Paul, Minn. Mr. Stickney's design calls for a turbine rated at 3,000 kw. capable of 20 per cent overload, operating at a steam pressure of 220 lb. per square inch, with a speed of 3,600 r.p.m. A feature of the design is the fly-ball and spring-governor action which works an oil relay, thereby moving the piston-valve opening or closing the parts to the nozzle

blocks. The steam consumption is calculated at 14 lb. per kilowatt-hour.

Accident at Paris, Ky.—The power plant of the Paris (Ky.) Gas & Electric Company was almost demolished on Aug. 24, when the flywheel, without any kind of warning, broke into a score of pieces, tearing down the front and rear brick walls of the power house and knocking a large hole in the roof. The wheel, which was 14 ft. in diameter and 26 in. in width, was constructed of cast iron. One piece, which was estimated to weigh at least 1,000 lb., was hurled a distance of 300 ft. through the side wall and floor of a near-by residence. This piece barely missed an occupant of the house who was lying in bed ill. R. B. Hayes, engineer of the plant, was thrown outside the engine-room door and rendered unconscious for a short time. Others in the engine room escaped injury. The accident, which was caused by the breaking of a drive belt, caused $10,000 damage.

The "Telehor," a Hungarian Invention.—After many years of experiment a Hungarian electrophysicist at Budapest has announced the invention of an electric "far-seer." The apparatus consists of two electromotors making 2,000 revolutions per minute, working independently of each other. For their synchronization a special apparatus has been constructed in connection with a metal relay which reflects the trivial resistance of the selenite plates as corresponding luminary alterations at the reproduction station. This metal relay is said to be of such an extraordinary sensitiveness that it registers 50,000 variations of the faint influences of the light per minute. The apparatus can, it is asserted, transmit pictures over long distances at a speed as great as ten per minute. Pictures, manuscripts, documents, signatures, etc., can be exactly reproduced.

Chamber of Commerce Establishes Bureau of Agriculture.—A move that is likely to have a bearing upon the efforts to take electricity to the farmers has been made by the Chamber of Commerce of the United States through the establishment of a Bureau of Agriculture under the management of William Harper Dean of Washington, formerly with the United States Department of Agriculture. "In keeping with the general policy of the national chamber," says the announcement, "the new bureau will make no effort to formulate on its own initiative any plans to offer for adoption by either agriculture or other industries, but rather to serve as an investigator of their common problems and to offer the results of these studies for such action as they may seem to warrant."

Oklahoma Company's New Plant at Harrah.—Construction of the Oklahoma Gas & Electric Company's 20,000-hp. plant on Horseshoe Lake, a mile north of Harrah, Okla., has been greatly handicapped by the fact that the site is above quicksand, necessitating the driving of concrete piles down to bed rock, but notwithstanding this the work is progressing rapidly. A huge coal pit is being sunk 40 ft. below the surface of the earth. The company has purchased a tract of 600 acres and as soon as the dam is finished will stock the lake with fish, construct summer cottages and make a summer resort for the benefit of its employees. The 1923 budget of the company for this plant and the similar one under construction at Muskogee, together with other improvements to the service now given to seventy-two towns and cities, has reached $10,000,000.

Electrical Progress in Yucatan.—The more important cities and towns contained in the Progreso (Mexico) Consular District have electric plants, principally for the furnishing of light, and incidentally for providing power to small industrial enterprises, according to a report to the Commerce Department from Consul O. G. Marsh, Progreso. Each plant is confined in its operations to its own immediate city or town. The complete absence of water power, the high cost of fuel—charcoal, wood and crude oil—the great area of the individual hemp plantations and the distances between cities and towns have limited the electrical development of this district. Its largest plant is in the city of Merida, the capital and largest city of the State of Yucatan. Merida has a population of 65,000 and is the principal market for electrical supplies. This plant, which has a capacity of 2,000 kw., supplying both direct and alternating current, furnishes light for the city streets and about five thousand houses and power for about three hundred electric motors.

Governing Water Release.—A report soon to be issued by the federal Bureau of Reclamation under the title "High-Pressure Reservoir Outlets" will describe the outlet works of the Arrowrock, Elephant Butte and Shoshone dams and the way in which the outrush of water is controlled by gates and valves of unusual design and capacity. There are in successful operation in the great government dams massive valves between 4 ft. and 5 ft. in diameter at the nozzle, operating under heads of 100 ft. to more than 200 ft. and controlling with perfect ease and security the tremendous force of the water as it is released from the reservoirs. The Arrowrock Dam, on the Boise River, Idaho, is supplied with no less than twenty needle valves, each with a nozzle diameter of 58 in., operating under a maximum head of 110 ft.; the Elephant Butte Dam, on the Rio Grande in New Mexico, contains four valves, each with a nozzle diameter of 60 in., operating under a maximum head of 120 ft., and the Shoshone Dam, on the river of the same name in Wyoming, has five such valves with nozzle diameters of 58 in., 48 in. and 36 in. respectively, operating under maximum heads of 220 ft. and over.

Associations and Societies

Electric Power Club.—The fall meeting of the Electric Power Club will be held at the French Lick Springs Hotel, French Lick, Ind., on Nov. 19-22.

National Safety Council.—The twelfth annual congress of this body will be held at the new Statler Hotel, Buffalo, on Oct. 1 to Oct 5. Sixty sessions of special and general interest will be held.

Institute of Radio Engineers.—This association will meet on Wednesday, Sept. 5, at the Engineering Societies Building, New York, when a paper on "Recent Developments in High-Vacuum Receiving Tubes," by J. C. Warner of the General Electric Company, and one on "Radio Transmission Measurements on Long Wave Lengths," by H. H. Beverage and H. O. Peterson of the Radio Corporation of America, will be presented.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel. 149 Tremont St., Boston.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-8. H. M. Stine, 212 Locust St., Harrisburg, Pa.

Electrical Supply Jobbers' Association, Pacific Division—Gearhart, Ore., Sept. 5-7. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

Pennsylvania State Association of Electrical Contractors and Dealers—Wilkes-Barre, Sept 12-13. M. G. Sellers, 15-18 Sansom Street, Philadelphia.

Conference of Electrical Leagues—Association Island, Sept. 16-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Great Lakes Division, N. E. L. A.—French Lick Springs, Sept. 26-29. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St. New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Commission Rulings

Municipal Plant Must Be Self-Supporting in the Public Interest.—In fixing rates for the municipal electric plant of Brookings the South Dakota Board of Railroad Commissioners declared that sound public policy indicates and the public interest requires that rates for municipal service be reasonable in and of themselves and sufficiently high so that the business will be self-supporting. The commission added: "The property, being municipally owned, is exempt from assessment and taxation, and to that extent the tax burden is shifted to other property. It is possible that, in a proper case, we would find it necessary and in the interest of sound public policy to give consideration to the establishment of rates to be charged by the utility that would be sufficiently remunerative so that the municipally owned plant or business would compensate the public treasury to the same extent that would be the case were the utility property owned privately. That issue is not before us in this case, however, and therefore we express no opinion in regard thereto."

Why Should Utilities Be Denied Full Enhancement of Value?—In proceedings affecting the Indianapolis Water Company the Indiana Public Service Commission, speaking by Commissioner Van Auken, said: "Peculiarly enough, it is never contended that the owner of any other sort of property than utility property should be denied the benefit of the full enhancement of value which may have occurred. Just why public utility property should be considered worth no more than its original cost is not explained, neither is it explained why utility property should be singled out from all other classes of property and its value considered to be what may have been paid for it at some distant day in the past. In this case the commission must say, 'How many dollars represent the value of this property at this time?' and not, 'How many dollars represent this value at some time in the past?' So-called 'enhancement of value' may occur, first, when there is no change in the purchasing power of the dollar by reason of various circumstances such as the natural increment of the land values in a growing city, and, second, by a decrease in the purchasing power or value of the dollar. . . . It is established by the evidence and is a matter of common knowledge that there has been such an enhancement of value during the course of the last few years. In other words, it takes a different number of dollars to measure the value of a property now from what it did ten years ago, although the inherent value may be the same. It is urged that the value of a public utility now is the number of dollars actually invested in the property. There is no reason why such a rule should be applied to public utility property, when it is never applied to the measuring of the value of any other kind of property. Any individual would be extremely aggrieved if it were suggested to him that the value of his farm or factory now should be measured and fixed on the basis of the dollar of ten or twelve years ago. It is not done, and the courts from the Supreme Court down have uniformly held that the purchasing power of the dollar at the time of the inquiry is material—that is to say, that the cost of reproducing the property at the time of the inquiry is an important element to be considered."

Recent Court Decisions

Discontinuance and Non-Payment.—Holding that the evidence showed the Springfield (Mo.) Gas & Electric Company to have waived its legal right to require written notice to discontinue service to the Landers Theater, the Springfield Court of Appeals reversed a judgment awarded in a suit of the central-station company against the Southern Surety Company of Oklahoma which was based on a card contract duly signed by an admittedly authorized agent. The Court of Appeals held that the contract was invalidated by the subsequent understanding between plaintiff and defendant. (250 S. W. 78.)*

Only Public Service Company May Have Review of Certain Questions.—Sustaining a finding for the defendant in City of Everett vs. Department of Public Works, the Supreme Court of Washington State refused to decree a review of the department's findings and orders affecting telephone rates, saying that, under the Washington statutes, while a complainant may have a review as to some findings or orders made by the regulating body of the state, only the public service company concerned may have a review of questions directly affecting the valuation of its property for fixing rates. (215 Pac. 1045.)

Powers of Ohio Commission. — The home rule provision of the state constitution is not effective to deprive the commission of its statutory jurisdiction in cases where the rates enacted by a municipality have not been accepted by the utility company and the contractual relation therefore has not been established, declared the Supreme Court of Ohio in City of Lima vs. Public Utilities Commission, a case in which natural-gas rates were concerned. Where a city by ordinance has provided that a company may fix and collect the minimum charge per month from each consumer, and the company has appealed from such ordinance to the Public Utilities Commission, the minimum charge is part of the rate appealed from, and the jurisdiction of the commission over the subject of rates includes the rate on the minimum charge. (140 N. E. 147.)

Valuation Procedure in the Light of the Supreme Court's Decisions.—In approving the granting of an injunction to the Monroe Gas Light & Fuel Company against the enforcement of rates prescribed by the Michigan Public Utilities Commission, the United States District Court reviewed the points at issue in the light of the many recent decisions of the United States Supreme Court that bear on the question of confiscation through rate schedules fixed by regulatory bodies. The District Court found that the Michigan commission had followed the lines indicated as proper in the subsequently recorded opinion of Justice Brandeis in the Southwestern Bell Telephone case, but pointed out that the majority opinion must now control, with all its necessary implications. Testing the commission's order by this and other findings of the Supreme Court, the Michigan tribunal declared that the rate fixed, which upon the commission's own figures would bring a return of less than 5½ per cent on reproduction cost, was clearly confiscatory. Said the court: "We must construe the majority opinion as the minority of the court interpreted it, viz., as holding that, where it stands not impeached or attacked otherwise than it was in the Southwestern Bell Telephone case, the reproduction cost is the dominating element in the fixing of the rate base; and if a commission which leaves it substantially unimpeached fails to give it that dominating effect, there is an error of law which the court must correct. The opinion in the Bluefield Water case tends to confirm this construction of the Southwestern Bell case. The rate base made by the commission was set aside because due regard had not been given to reproduction cost. . . . Nor do we find anything inconsistent with this view in the opinion in the Georgia Power case. It affirms only that the reproduction cost at the date of the inquiry is not necessarily controlling. . . . Our Court of Appeals suggested in the Louisville railway case that a three-year period was about as short as should be contemplated when a rate is fixed. Clearly the commission should look forward to such a period, and if there is anything before it from which it may draw a reasonable conclusion that the average cost will be higher or lower than the present cost, it may give due weight to that conclusion, subject, of course, to correction if the future demonstrates an error; but we do not understand that a commission can make or act upon a finding of this kind, express or implied, unless there has been evidence thereon and the utility has a chance to be heard."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

J. C. Martin Joins Middle West Utilities Company

J. C. Martin, who has been Western editor of the ELECTRICAL WORLD stationed at Chicago since 1920, has resigned to accept a position with the Middle West Utilities Company in its Chicago office. Mr. Martin enters on his new duties Sept. 1. Before joining the editorial staff of the ELECTRICAL WORLD he had been identified with the engineering organizations of central stations for seventeen years. He entered the utility field in 1903, when he joined the Cedar Rapids & Iowa City Railway & Light Company. After serving this company for eight years in nearly every department he became engineer with the Pacific Power & Light Company of Portland, Ore., and was soon made assistant to the chief engineer and subsequently chief engineer. In October, 1917, the Electric Bond & Share Company, which controls the Pacific Power & Light Company, sent Mr. Martin to Allentown, Pa., to take charge of engineering work for all its properties in that state. For two and a half years previous to assuming his editorial duties in Chicago Mr. Martin engaged in consolidation and construction work with these companies.

Mr. Martin, in addition to his editorial activities, has contributed the results of his experience in many other ways to the electrical industry. Among other things, he has been an active member of the rural-lines committee, the overhead systems committee and the inductive co-ordination committee of the N. E. L. A. and also a member of the protective devices committee of the A. I. E. E. His past experience in the operating field and his opportunities to observe the practices in a large number of companies during his editorial work will give him a particularly useful background in his new position, where his attention will be devoted principally to operating problems.

C. S. Woodward, secretary of the Iowa Electric Company, Cedar Rapids, Iowa, has in addition assumed the duties of treasurer of the company.

E. B. Smith, assistant to the general auditor of the Oklahoma Gas & Electric Company, has been made manager of the central division of the company, with headquarters at Sapulpa. Mr. Smith has been associated with the Oklahoma Gas & Electric Company since 1918, when he was transferred from Pueblo (Col.) to Muskogee as auditor there. A year later he became auditor of the local division at Oklahoma City, and in October, 1919, he was advanced to the position he occupied at the time of his recent promotion. Mr. Smith is succeeding R. C. Coffy, who has gone to Fort Smith, Ark.

A. M. Perry Becomes Western Editor of "Electrical World"

Allen M. Perry, who has been a member of the editorial staff of the ELECTRICAL WORLD since February, 1913, at present holding the title of engineering editor, has accepted appointment as Western editor of the paper and will henceforth have headquarters at its Chicago office. Before taking up editorial work Mr. Perry was

A. M. PERRY

in the operating department of the Grand Rapids & Muskegon Power Company, which was later absorbed by the Consumers' Power Company, and also had had some experience in the design of electrical equipment. Mr. Perry's first connection with the ELECTRICAL WORLD was in the Chicago office, where he spent about a year. During the years he has been in the New York office he has contributed with ability to all of the departments of the paper, specializing since 1917 in engineering features. He has built up a large and intimate acquaintance among engineers and others as well. He has always endeavored to have the engineering articles reflect active problems in the industry and in searching the field for best practices has made first-hand studies and established points of contact in at least thirty states of the Union. His accomplishments in his past work, added to his general experience and his eleven years' intimate association with all divisions of the electrical industry, form an excellent background for undertaking the broader editorial responsibilities of the Western editorship, where his work will cover activities in the entire industry throughout the territory of the Central States.

Mr. Perry is a graduate in electrical engineering of the University of Michigan. He is a member of the American Institute of Electrical Engineers and the Illuminating Engineering Society. For several years he has been a member of the Institute's transmission and distribution committee, and he has also been a member of the publications and reciprocal relations committees and of the New York board of managers of the Illuminating Engineering Society.

L. A. Safford, formerly manager of the Pacific Power & Light Company at Kennewick, Wash., has been made manager of the Walla Walla branch of that company to succeed Charles Walters, who recently went to Asheville, N. C., as vice-president and general manager of the light and power company.

Frank Wampler of Indianapolis has been appointed a member of the Indiana Public Service Commission by Governor Warren T. McCray to succeed Glenn Van Auken, whose resignation was accepted by the Governor to become effective Sept. 1. The new appointee was formerly vice-president and general manager of the Indiana Bell Telephone Company and is well known throughout the state.

W. H. Crutcher, for the past five years general superintendent of the gas department of the Oklahoma Gas & Electric Company, has been made manager of the eastern division as successor to Mr. Wilmarth. For thirty years Mr. Crutcher has been associated with the Byllesby organizations, and during that period he has consistently won promotion and accordingly assumed increased responsibilities, culminating in his selection as managing head of the eastern division with headquarters in Muskogee.

Karl Jorgensen, industrial engineer and accountant, who since 1919 has been engaged in system and organization work for the Commonwealth Edison Company, the People's Gas Light & Coke Company and other Insull companies in Chicago, has severed his connection with the Bureau of Commercial Economics of that city. Mr. Jorgensen will practice industrial engineering and public accounting with offices in Los Angeles. His first engagement will be a survey for the Southern California Gas Company.

John L. Harper, vice-president and chief engineer of the Niagara Falls Power Company, spent more than two months in Europe this summer, visiting France, Italy, Switzerland, England and Norway. Mr. Harper looked over several of the most interesting water-power developments of the different countries. In Norway he visited, among other places, Tyssedal and Sauda, where American capital is invested. Passing through some of the most beautiful parts of Norway, he had an excellent opportunity of seeing the possibilities

of the country from the point of view of the tourist as well as the hydraulic engineer. Mr. Harper sailed for home from Liverpool on Aug. 10.

Vern Capple is the new chief engineer of the Pontiac (Mich.) property of the Consumers' Power Company. Mr. Capple has been acting vacation relief man on the Au Sable River.

Erwin Humes of the distribution department of the Empire District Electric Company has been transferred to the position of power salesman at Elyria, Ohio.

W. J. Parker, formerly associated with the Fort Smith (Ark.) Light & Traction Company, has been made manager of the Oklahoma Gas & Electric Company at Sulphur, succeeding W. B. Christie.

Clair V. Merriam, power salesman for the Puget Sound Power & Light Company at Seattle, Wash., has been appointed sales manager of the Eastern Texas Electric Company, with headquarters at Beaumont, Tex.

J. T. Boifeuillet has been made vice-chairman of the Public Service Commission of Georgia, succeeding J. A. Perry. Chairman P. B. Trammell was re-elected for another term of two years.

Fred Brown, who has operated at the Charlotte substation and at the Jackson steam plant of the Consumers' Power Company, was recently transferred to electrical construction work at the new Saginaw River plant.

S. W. Winge, formerly superintendent of the municipal light plant at East Grand Forks, Minn., is now connected with the power and light department of the Indiana Service Corporation, Fort Wayne, Ind.

Harold W. Hahn, formerly sales manager for the Duplex Lighting Works of the General Electric Company, has become sales manager of Cox, Nostrand & Gunnison, Inc., illuminating engineers of Brooklyn, N. Y.

Carl J. Sittinger, who for the past four years has been associated in consulting engineering work with John A. Stevens of Lowell, Mass., is now engineer in the electrical division of Stone & Webster, Inc., Boston.

Howard E. Batsford is now field engineer with the Utica (N. Y.) Gas & Electric Company in charge of ordering material and constructing substations. During the past two years Mr. Batsford has been engaged in maintenance work as wireman.

L. M. Smith, assistant chief engineer of power houses for the Tennessee Coal, Iron & Railroad Company, Ensley, Ala., for the past three years, has resigned to become connected with the engineering department of the Alabama Power Company, Birmingham.

Edward S. Mansfield, superintendent of the operating bureau accounts department of the Edison Electric Illuminating Company of Boston, has been appointed chairman of the electric transportation committee of the New England Division of the National Electric Light Association.

W. G. Schmauder, formerly assistant general manager of the Texas Power & Light Company, has gone to Cuba, where he will assist in the operation of a number of electric plants. Lee Schneitter and C. B. Oliver, also formerly of the Texas Power & Light Company, have become identified with the same Cuban properties.

E. M. Breed, assistant manager of sales of the Pelton Water Wheel Company, has been appointed sales manager of the company, with headquarters in San Francisco. Mr. Breed has had wide experience in hydro-electric work, having been connected with the Pelton Water Wheel Company in various capacities for the past fifteen years.

W. S. Berry, who for a number of years has been sales manager of the Western Electric Company at San Francisco, has been made manager of the San Francisco office. Mr. Berry has a wide acquaintance among the jobbers on the Pacific Coast and has been active in the Electrical Supply Jobbers' Association in that section.

C. C. Hillis, prominent jobber of San Francisco, formerly vice-president of the Electric Appliance Company, is now the president and general manager. Mr. Hillis has taken an active part in the Electrical Supply Jobbers' Association and the affairs of the California Electrical Co-operative Campaign.

Merrill E. Otis has been appointed chairman of the Missouri Public Service Commission to succeed the late John A. Kurtz of Kansas City. Mr. Otis has been chief assistant to Attorney-General Barrett and is a native of Nodaway County. After graduation from the Missouri University he engaged in the practice of law in St. Joseph, serving as assistant city counselor and later as assistant prosecuting attorney of Buchanan County.

Thomas H. Dooling has been appointed manager of the automotive battery sales division of the New England branch of the Electric Storage Battery Company, with headquarters at Boston. Mr. Dooling has been connected with the company since 1903 with the exception of the period when he served in the United States Signal Corps on the Mexican border and in the war. Recently he was stationed in the San Francisco office of the company.

J. F. Roche has been appointed Chicago district manager of the Apex Electrical Distributing Company, following his resignation as advertising director of the Edison Electric Appliance Company. Mr. Roche was for a number of years associated with the Billings (Mont.) office of the Montana Power Company, where he was very active in developing the sales of electric ranges. From there he went to Butte as district manager of the company and subsequently joined the Edison Electric Appliance Company. In performing the duties of his new office Mr. Roche will handle sales for eight Western states.

Fred Garrison, formerly connected with the engineering department of the Southern California Edison Company, has recently joined the engineering department of the General Electric Company in the Los Angeles office as assistant to E. E. Valk. Previous to his association with the Southern California Company Mr. Garrison was connected with the General Electric works at Schenectady.

Granville Lyon, formerly connected with the securities department of the Wisconsin Power, Light & Heat Company of Madison, has been appointed manager of the utilities' securities department recently organized by the Eastern Wisconsin Electric Company at Fond du Lac, Wis. Mr. Lyon not only heads the new department but he will also handle this branch of the company's business in Wisconsin. The rapid growth in the securities business of the company necessitated the formation of a separate department to take care of the stock and bond sales under the customer-ownership plan.

James E. Miller of Chicago, formerly a consulting engineer with the General Engineering & Management Corporation of New York City, has been appointed trade commissioner of the Department of Commerce at Calcutta, India, according to an announcement made by Secretary Hoover. For several years subsequently to his connection with the General Engineering & Management Corporation Mr. Miller was engaged with the Westinghouse Electric & Manufacturing Company, covering engineering construction and sales in the United States, Canada, England, France, Russia and South America.

E. F. Strong of Cleveland has been appointed general manager of the Shelby Lamp Division of the National Lamp Works of General Electric Company, succeeding C. C. Skiles, whose resignation took effect July 31. The Shelby Lamp Division moved recently from Shelby, Ohio, and is now located in Buffalo, N. Y. Mr. Strong has been engaged in the lamp business since 1905. Since 1906 he has held positions of sales and factory manager of various sales divisions and plants of the National Lamp Works. His long and varied experience makes him eminently fitted for his new position.

E. J. Spencer, secretary-manager of the St. Louis Electrical Board of Trade, has resigned to become vice-president and general manager of the Brown & Hall Supply Company, St. Louis. John A. Laird has been selected to fill the secretary-managership of the board. Mr. Laird, who is a graduate of Washington University in electrical engineering, was engaged as mechanical engineer on the construction of the St. Louis waterworks and was connected with the water department of that city until 1917, when he enlisted for service in the war. Since the close of the war he has been associated with R. W. Morrison and W. S. McCall in public utility work, with offices in St. Louis.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Remove This Obstacle to Appliance Use

Standardization of Terminal Plugs Must Be Supported by General Introduction of Interchangeable Cords for Old Appliances

By Ernest B. Slade
President Beaver Machine & Tool Company, Newark, N. J.

THE leaders of the electrical industry have recognized that the attachment cord is vital to the popularity of the household appliance. The cord is naturally the part that gives out first because it receives more handling, more abuse and more actual wear than any other part. It is the weak spot in almost every appliance, the first source of trouble to the central station and the manufacturer.

But in addition it has been and continues to be the chief source of inconvenience to the householder, the owner. Because the various manufacturers each wished to make his product distinctive, they each equipped their flatirons, percolators and the rest with their own particular type of connecting device at the appliance end of the cord. As a result there have been an endless variety of appliance plug fittings and cords that are purchased with one appliance but cannot be used on another. In a home there may be six appliances with six cords of various colors—perhaps several the same color—yet no two are interchangeable. This is all common knowledge, and because of this condition the N. E. L. A. wiring committee has been working toward securing the acceptance of a standard appliance terminal post, a standard plug design for the appliance end of the cord, and with some success, since already one style of round prongs and one style of flat prongs have been made standard for all. It is the first step to meet the simple obvious necessity to make electrical appliances easy to use with any cord in any home.

E. B. Slade

Keep Appliances in Use

There remain two things to do—first, to secure the universal adoption of a single interchangeable appliance terminal post and plug by all manufacturers, and second, to sell the idea of the importance of this interchangeability to the central-station companies and dealers who sell appliances into the home. This will eventually lead to the complete interchangeability of appliances. In the meantime, however, there remains to be reckoned with the large diversity of appliances now in the home. These require either a large diversity of appliance-end plugs or some kind of a plug that is interchangeable and fits any appliance, no matter what kind of terminals it has, and that is safe for use with all. There are today several such interchangeable cords available, and at least one of them has been formally passed and approved by the Underwriters' Laboratories for use with ordinary heating appliances.

It would seem that the first step toward complete facility in the use of household appliances would be the introduction into the homes of the people of the greatest possible number of these interchangeable attachment cords. About 3,500 central stations, or 60 per cent of the light and power companies, are now maintaining retail departments for selling electrical household appliances. It is safe to say that these 3,500 companies comprise most of the larger light and power stations. This remarkable increase in appliance selling by utilities is in recognition of the profit value of the retail sales, the income value of this residence load and the public relations value of appliances. However, too many light and power company executives interested in this end of the business do not go any further. They do not realize that in order to complete their job they must keep those appliances in use, and that the attachment cord is just as important as the convenience outlet in making their use easy.

Cord Replacement Problem

Now the first thing that gives out on most appliances, as I have said, is the cord, and when that happens the revenue from the appliance stops. It is therefore of vital importance that all cords be maintained in service on all types of appliances that may be on the lines. The companies should be prepared to furnish replacement cords for any device, no matter where or when it happened to be bought—a very difficult thing when one considers the number of varieties of connecting plugs that this now requires.

The making up of "home-made" heater cords is all right for the little dealer who has lots of spare time and figures that his own labor in assembling the cord "costs nothing." However, the light and power company's accounting department will undoubtedly figure that it costs something for it to provide a man who is capable of properly assembling appliance cords.

The difficulty or inconvenience of the situation has been felt, and most heating appliance companies sell replacement cords complete for their appliances. This, however, in turn, is possibly only less inconvenient than having to make up the cords "to order," because it necessitates the central station carrying in stock

different cords for all the different appliances they are selling. This need, however, is now cared for by the interchangeable appliance attachment cord which the manufacturer supplies in attractive cartons ready to hand out to the customer without any delay or questions as to what he wants or what kind of an appliance he wants it for.

End Cord Trouble Now

The stage is set, therefore, for the gradual elimination of cord complications—first through the use of an interchangeable cord and then through the adoption of a standard terminal post and plug by all manufacturers, and eventually by the elimination of all the old appliances with "maverick" terminals, as they become worn out and are discarded. The question is what can be done to speed the clearing up of the confusing situation as it exists today. Obviously, the vital step is for all manufacturers of household appliances with detachable cords to standardize their plugs on the appliance ends. Then I believe that they and all their jobbers and dealers should in addition endeavor to sell to every customer into whose home a new appliance goes an interchangeable cord as well, so that if they already are using some other device requiring a different appliance-end plug, this interchangeable cord will at once establish interchangeability in that home.

Central-station companies also must be induced to sell interchangeable cords wherever they run into cord trouble. No stone should be left unturned to introduce as many of these interchangeable cords into the homes of appliance users as possible, that this element of inconvenience, this ever-present and persistent obstacle to the free use of appliances, may be eliminated for all time.

Effect Upon Credit of New Lines of Merchandise Such as Radio*

By A. F. Hearl
Secretary and Treasurer American Electrical Supply Company, Chicago

THE manufacturing and exploiting of new lines of merchandise always confront the industry as an essential of progress. As washing machines, vacuum cleaners and other appliances were added to our regular line of merchandise we faced new ideas in credit extension and relations with our customers were disturbed by departure from old and established credit terms. In our attempt to speed up and increase volume in sales of new appliances our sales departments succeeded in making time-contract and deferred-payment plans appear very attractive to the purchaser, who in many cases had no capital but would buy anything and everything that he could get "on time."

Our contractor customers became dealers and merchandisers. We helped them put on big sales campaigns, spent large sums for advertising, and before the credit department realized it were extending credits of $1,000 to customers who were previously being held to $100 limit on regular lines. While this departure from conservative credit principles increased sales, it resulted very often in over-expansion of capital, in consequent inability to liquidate obligations and in some of us absorbing the ultimate loss; so at least temporarily credit was affected by the addition of these new lines until we had learned our lessons and worked out ideas of financing time payments by using the bankers' money instead of our own. Things were commencing to look natural again, when—along came radio.

Radio Still Needs Watching

In my humble opinion, radio is here to stay, but is as yet more or less in the experimental stage, not only as to radio itself, but as to the proper handling of it from a credit standpoint. We will meet this new line fairly and squarely as it develops, because it may become a very important part of the electrical industry, and if credit is extended on ethical and sound principles, there need be no further effect exerted upon credit by this new line of merchandise.

Washing machines and vacuum cleaners were household necessities. They were adopted slowly, however, and we did have a chance to think between sales. Radio, on the contrary, struck like lightning out of nowhere. Unmistakably thousands of men embarked in this new line without capital, without business qualifications and without the least bit of knowledge of radio. They were intoxicated by the anticipation of handsome profits that came with this new line. We saw the fall of many of these mushroom firms last year, but there are many still here, and seeds have been sown where still more will crop up next season. Not only are the new dealers to be watched, but many of our old steady customers are losing their balance and investing in radio stocks to such an extent that credit is threatened by their tying up capital in something that may be obsolete by the time it gets on the shelf, or the value may decrease quickly from competition, now so common; but if the customer has been fairly prompt in meeting his obligations in the past, it is difficult for the credit man to know where or when to draw the line.

Credit Counsel Will Help

We have had in radio many conspicuous examples of the effect of new lines on credit, and I think that besides affecting credit sometimes these new lines disrupt the policy of buying too. Early last year radio material was hard to get. Demand exceeded supply, and to get any kind of a shipment at all buyers were placing orders with jobbers far in excess of what they needed or ever expected to receive. Quite naturally the jobber made large commitments with the factories. There was a happy condition then for the credit man, because he could ship C.O.D. or even receive cash in advance; but soon another situation developed. Contrary to our old-established lines of merchandise, radio proved to be a seasonable business. Buyers became fewer during certain months, factories caught up with their orders, new factories started up, competition arose and prices came down. Then we saw breach of promise, cancellation of orders, refusal of C.O.D. shipments and default of many kinds. A lot of money was lost, confidence betrayed, and no matter how or why it occurred, the credit department came in for its share of the blame and many firms suffered a loss trying to cope with conditions incidental to adding a new line of merchandise.

Granted that radio is going to develop from a toy to a necessity and become an established line of merchandise in our industry, let us not lose our balance in the handling of

*From a paper presented before the twenty-fifth annual convention of the National Electrical Credit Association at Boston, Aug. 9-10, 1923.

credit. Before many weeks the craze will be on again in full swing. Let us resolve that radio, or any other new line, is just a commodity to be sold either for cash or to persons of approved credit, as we sell any other electrical merchandise. Then, just because it is radio, that mystifying, hypnotic, irresistible thing that attracts every one, let us keep an eye on where it is being sold, and if we find that any of our good contractor customers are forgetting how to wire a house and are hooking up radio sets let us go to them—and if they are worth selling to, they are worth our counsel. Let us tell them what we know about how this new line affects their real activity, or advise them how to handle it conservatively so as to show profits on the sales. The credit man's sphere is unlimited. Let him do his share in the development of this wonderful new line just added to our business in any way he can.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

BUSINESS in electrical commodities has been well sustained throughout the country this week, but there have been no spectacular developments. While the building industry is still actively engaged on the large volume of construction undertaken this year, new projects are beginning to fall off and many jobs are nearing completion and this market does not engage the attention of electrical manufacturers so strongly as in the recent past. On the Pacific Coast bare and weatherproof wire have fallen off a little in price and schedule material generally is selling at a low figure, but business is fair, with much activity in the lighting and industrial power fields.

Trade has been quiet in the Middle West, with pole line hardware and high-tension equipment in rather active demand and appliance sales holding up well in spite of the fact that fall buying has not begun. In the East appliances have been rather quiet, with active selling of motors, meters and transformers. Manufacturing facilities seem to be fully occupied. Considerable construction work that has been delayed by other trades has been starting up and contractors are buying to relieve depleted stocks. Competition for orders seems to be active throughout the country, with a tendency toward conservative ordering and careful price adjustment to local trends. Collections are apparently normal.

Price Trends Reflect Cost Fluctuations

PRICE movements in the field of electrical material supply indicate considerable sensitiveness to local cost conditions at this time. Competition for orders seems to be active throughout the country, although the general volume of business is large enough to put a fairly heavy tax upon current manufacturing facilities. At the beginning of this week flexible armored conductor and rubber-covered wire softened somewhat, and brass was quoted on a lower basis than of late. The opinion was advanced Monday that the drop in flexible armored conductor represents but a temporary condition. For many weeks the production of this material has been more than adequate for current demands, judging from the lack of complaints regarding deliveries to jobbers. Sockets had not followed the brass reduction downward as the week began, but there has been a disposition of late among some manufacturers to pass along such cost reductions in their quotations on finished products, hoping thereby to stimulate more buying for stock on the part of distributors.

All these movements are regarded by some commercial engineers as of minor importance compared with the sustained high cost of labor in modern industry, this cost powerfully affecting the possibilities of profit all along the line from the raw-material producer to the ultimate consumer. "Overheads" are receiving much executive attention also; but the early trend of prices as a whole appears to depend more upon labor conditions than upon any other factor except in lines where automatic machinery and mass production of comparatively simple commodities control factory costs.

Decreased Building Operations Have Cut Down Porcelain Sales

PORCELAIN sales are considerably below those of six months ago, a condition which the majority of manufacturers attribute in part to the general falling off in building operations and the resultant hesitancy on the part of both jobbers and dealers to stock material in advance. For during the year little wiring of old houses has been done, and very little porcelain is being used in new construction of any kind because of the wider adoption of armored cable and rigid conduit.

In the wiring-device field also there has been a marked trend toward the use of rubber-composition products to avoid dangerous breakage. The strongest place in the porcelain market is the high-tension equipment field, where during the last seven months demand has exceeded supply. All manufacturers agree, too, that large sales are continuing to the South and Southwest for use by the telephone companies and in connection with the installation of farm-lighting plants, but that tubes, cleats and knobs are doled out to the jobbers of the Eastern, Middle Western and the Pacific Coast sections by single barrels only. More business is reported in the Northern territories.

Makers of special porcelain report that the increasing business being done by the heating-appliance and automotive spark-plug manufacturers is holding their orders up to a rate exceeding that of any year since 1919. In this field the greatest demand is for hand-turned and "quality" products, little interest being shown in short-lived grades. The makers of very low-priced heating appliances have come to understand that the porcelain of a heater, a small stove or a range must be perfect even if the heating element and standard are of poor quality.

Deliveries of porcelain are no longer than normal—in fact, they are very much more prompt, which, of course, is due to the fact that production has caught up with consumption. General prices have not changed materially in recent weeks, nor do manufacturers see anything in the outlook for the immediate future which would appear to justify a change. As regards the outlook for the next half year, manufacturers are inclined to believe that business will be fairly active during the fall and early winter. They base this belief on the assumption that building operations will be increased after the summer lull and that jobbers and dealers will show a greater tendency toward stocking goods.

Steady Motor Business Anticipated for Rest of Year

BARRING relatively small fluctuations in demand above and below the present level, the sale of electric motors this fall bids fair to continue in a highly satisfactory general volume. Manufacturing plants are booking orders considerably above last year's rate, and although current sales are possibly 10 or 15 per cent below the volume of late spring orders, the normal fall "pick-up" is expected to materialize by October and to bring the year to a close with a total well above 1922. Motor deliveries out of factory stocks are being made promptly on most standard lines, and raw material on hand is ample for the needs of many weeks ahead. Some manufacturers, in fact, are sharply checking raw-material stocks on hand against future commitments, and for the moment there is a slight lull in purchasing copper, steel and insulation in view of the moderate recession in demand and the adequacy of the existing supply, combined with the reasonable probability of obtaining raw-material deliveries in the next few months.

The production of special motors still absorbs a substantial proportion of manufacturing output. In some factories this has arisen of late to roughly one-third of the total motor output

A representative engineer stated recently that to produce one motor of special design costs as much in manufacturing facilities as it does to produce two or even more standard units. The pressure is therefore heavy upon manufacturers to concentrate the production of standard motors in establishments where the principles of mass output can be fully utilized, and in some companies this policy is receiving more and more attention. The separation of different sizes and types of motors from the manufacturing standpoint is a marked feature of modern development, and different parts of the country are becoming known as centers of particular classes of motor design and production. The motor price situation is unmarked by any notable movement at the moment, although competition is especially acute among smaller manufacturers. Wages are high and have shown little tendency toward deflation of late. Much progress is being made in the direction of new motor designs, and the fall is likely to witness radical improvements in this class of equipment looking toward the simplification of control and increased reliability of service. The recent Electric Power Club agreement as to motor temperature ratings is being well received by purchasers.

A Flutter in Lighted Signboards

THE recent announcement that three entire floors of the Hotel Cadillac, occupying the entire frontage between Forty-third and Forty-fourth Streets on Broadway, New York City, had been rented for a term of years by a prominent manufacturer of electric signs and billboards in order to obtain permission to cover the front of the building with an electrically illuminated sign has naturally attracted a great deal of attention. The manufacturer is said to have paid $90,000 for the lease of the three entire floors of the hotel, including the ballroom floor. This makes a front equivalent to four stories which will be withdrawn from all hotel uses in order that the windows may be covered up with the sign.

Not long ago a similar transaction withdrew from ordinary business uses several floors of an office building on Columbus Circle, New York, at Fifty-ninth Street, where an illuminated billboard 40 ft. high by 80 ft. long will be displayed. A similar lease on Astor Place, New York, has withdrawn three stories of a loft building, a space measuring 40 ft. x 114 ft., which will be covered by an illuminated billboard. The inference would seem to be that the advertising "circulation" of a building in New York today in a prominent location is worth more than the space it provides for the ordinary purposes of business. In the case of the Columbus Circle sign, the rental of the office space would amount to $10,000 a year, but the rental of the sign space is said to be $50,000 a year.

Sign manufacturers and large billboard companies, however, are both emphatic in declaring that these instances do not indicate a trend either nationally or in New York itself. Unusual real-estate conditions have served to reduce the value of hotel and restaurant properties, and a few situations have been found where the owners prefer to close up a building and lease its exterior for a sign. There is no question, however, that the popularity of illuminated billboards is growing steadily.

Five years ago billboard manufacturers adopted a standard type of billboard carrying appropriate ornamentation and eliminating unsightly features of previous billboard construction. In tune with the widespread sentiment in favor of reducing the disfigurement of country scenery by the placing of billboards at spots of beauty, the Poster Advertising Association has been working to reduce the number of country signs by discouraging competitive bill board advertising along the highways, concentrating the billboard "showings" closer to the centers of population and the sources of supply of the goods advertised. This move is meeting with popular favor and, coupled with the distinct improvement in billboard art and design which followed the enlisting of the country's best artists in poster service work for the Liberty Loan drives, criticism and interference by art critics and civic clubs are less common.

The number of electrically lighted billboards compared with non-illuminated billboards throughout the country is increasing steadily. What is termed a "complete showing" in the Boroughs of Manhattan and the Bronx, New York City, consists of 300 boards, of which 126 are lighted. In Hartford it numbers forty boards, of which six are illuminated; in New Haven, fifty boards, of which ten are illuminated. Roughly, about 20 per cent of the billboards throughout the country are electrically lighted today. This is a direct result of the increasing popularity of the automobile and motion picture shows. Both these influences are bringing more and more people out onto the streets in the evening and greatly increasing the possible "circulation" of an advertising billboard, provided that it is illuminated so as to be readable at night.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.0327	$0.0278
Cold finished shafting, per lb.	0.0428	0.0428	0.0415
Brass rods, per lb.	0.1741	0.1825	0.1413
Solder (half and half), per lb.	0.276	0.276	0.180
Cotton waste, per lb.	0.1231	0.1231	0.10
Washers, cast iron (⅛-in.), per 100 lb.	4.66	4.66	4.06
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	37%	46⅔%
Machine bolts, up to 1-in. x 30-in., off list	44⅓%	44⅓%	59%

Delinquent Electrical Accounts Showed Material Increase in July

ACCORDING to the July reports of the National Electrical Credit Association, Chicago, the number of delinquent accounts for the five sections reporting showed a material increase over the figure for June. For the central division there was a decrease of three accounts from July, 1922, with an increase of average amount to $126.23 from $120.55. The Pacific Coast section showed the largest increase, the number increasing by twenty-three delinquent accounts over July, 1922. The average amount jumped to $222.01 from $98.51. The complete report is as follows:

DELINQUENT ACCOUNTS IN JULY

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
June, 1922	701	$79,207.62	$112.99
June, 1923	721	95,133.51	131.95
July, 1922	727	87,643.24	120.55
July, 1923	724	91,394.71	126.23
New York:			
June, 1922	479	69,303.00	145.00
June, 1923	428	50,758.00	118.00
July, 1922	395	54,704.00	139.00
July, 1923	404	61,434.00	152.00
Philadelphia:			
June, 1922	207	22,401.38	108.22
June, 1923	227	24,580.53	108.28
July, 1922	261	23,083.53	88.44
July, 1923	238	20,651.30	86.77
New England:			
June, 1922	81	10,152.24	126.57
June, 1923	29	2,325.95	80.20
July, 1922	55	6,779.49	123.26
July, 1923	26	3,062.32	117.78
Pacific Coast:			
June, 1922	18	2,353.13	130.75
June, 1923	52	13,873.41	266.80
July, 1922	13	1,280.71	98.51
July, 1923	36	7,992.57	222.01

Business Active in the East, Buying Conservative but Strong

ATLANTIC COAST electrical interests report well-sustained activity from week to week. A large percentage of manufacturing facilities is fully occupied, and apparatus builders are receiving a good volume of new orders. Jobbers' stocks are in liquid condition, with little complaint as to deliveries or shortages. Conservative buying rules in view of price uncertainties. Here and there raw-material costs tend toward lower figures, and in the absence of a rush of orders for supplies overtaxing production considerable competition is apparent. Underlying credit conditions appear healthy, and the banks report dullness in current demands for accommodation. Brass fell off ½ cent per pound on many lines during the past week.

The sale of motors, meters and transformers continues in excellent volume,

but appliance movement is quieter pending the usual autumnal increase in sales activities directed toward a more responsive public. Building contracts in New England totaled $5,761,000 for the week ended Aug. 21, against $7,585,000 for a year ago. This year's figure, however, exceeds all but two corresponding weeks for the past twenty years. Labor conditions in New England are quieter than for some time; general business is good, and the outlook is excellent.

Lighting and Power Sales Engage the Coast—Stocks Down

MORE attention is being given to the development of lighting business and industrial power at present on the Pacific Coast than to the following up of building operations. There is plenty of building under way and every available craftsman is employed, but the headlong rush of construction seems to have slackened somewhat. The higher steamer rates which have recently gone into effect have apparently not influenced Coast prices to any extent, beyond such carload commodities as rigid-iron conduits. Bare and weatherproof wires continue to decrease slowly in price; the rubber-coated wires are reported firmer.

A noticeable trend is seen to place toggle and tumbler switches on the same price basis as corresponding flush switches, and schedule material generally is showing great activity under the stimulus of the exceedingly low prices which prevail. All in all, general business in the Pacific States evidences a firmer and steadier tone this week, and the electrical industry is busily engaged in a very confident state of mind.

A Quiet Week in Chicago, but with Good Pole and Appliance Sales

CHICAGO electrical jobbers report a very quiet week of trade in that locality. Business seems to have reached a point where very little buying is going on, and wholesalers are maintaining small stocks, buying from day to day. Building activity is not up to the previous months this year, and this, together with the conservatism of the jobber in placing orders, no doubt accounts for the slump in business. Pole-line hardware, however, is somewhat active, and although in some instances poles are becoming more plentiful, the demand is pretty fair for this class of material. Prices remain firm.

Iron conduit is the only commodity which is considered likely to increase in price in the near future. High-tension equipment sales to the central-station companies have been good, considering the month as a whole. Summer sales of appliances are running along at a healthy rate, although the volume of sales is primarily dependent upon the effort expended in making the use of appliances more attractive to the public. Washing machines and vacuum cleaners are being delivered in good volumes, and the smaller-sized appliances are also holding up well. This applies particularly to grills, toasters, urns and percolators.

The Metal Market

THE metal market has been quiet this week with little buying. Foreign demand has shut down apparently on fear of a coal strike here. Copper has been selling below 14 cents and may go down after Labor Day. Lead is strong because the supply is not equal to the demand and the price is up to 6¾ cents. The zinc market is quiet with prices unchanged; production has been cut down and producers are not pressing the metal on the market. Tin is firmer due to London influences.

NEW YORK METAL MARKET PRICES

	Aug. 22, 1923 Cents per Pound	Aug. 29, 1923 Cents per Pound
Copper, electrolytic	14.25	14.00
Lead, Am. S. & R. price	6.50	6.75
Antimony	7.75	7.55
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.20	6.90
Tin, Straits	39.00	40.75
Aluminum, 98 to 99 per cent	26.00 to 27.00	25.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

General Electric Business Healthy

Following a meeting of directors of the General Electric Company at Boston last week, it was announced that incoming business for the first and second quarters of the current year totaled $80,000,000 and $84,000,000 respectively, and that while a slight recession has occurred since June 1, nothing in the nature of a slump is evident. Unfilled orders increased since Jan. 1 last from $76,000,000 to $96,000,000. Export business is gaining in Canada, Mexico, South America and Australia.

In a Boston News Bureau analysis based upon information obtained from the company's officials it was pointed out that the average selling price of the company's products reached a peak of 155 in 1920 on a base of 100 in 1914, compared with a general commodity price of 231 as computed by the United States Bureau of Labor Statistics. The average price of General Electric products in 1922 was 125 against a commodity price of 152, and at no time have incandescent lamps exceeded 104 since 1914.

Hart & Hegeman Company Acquires Entire Stock of H. T. Paiste

The Hart & Hegeman Manufacturing Company, Hartford, Conn., has acquired the entire capital stock of the H. T. Paiste Company, Philadelphia, and the two companies will now be operated as one. For ten years the Hart & Hegeman company has been associated with the Paiste company as selling agent. The latter organization has been in business more than thirty years, having been organized by H. T. Paiste, who has been president and manager during that period.

Consolidation was effected through the merger of the two companies, Mr. Paiste exchanging his interest in the Paiste company for an interest in the Hart & Hegeman organization. Mr. Paiste will become a director and officer of the last-named company and will continue as manager of the Philadelphia division.

The officers of the Hart & Hegeman Company will be: Shiras Morris, president and treasurer; Monroe Guett and H. T. Paiste, vice-presidents; S. P. Williams, secretary; Edward C. Swan, assistant treasurer, and H. L. Everest, sales manager.

American Brass Company Makes Price Reductions

Price reductions ranging from ¼ cent to 1 cent per pound were announced last week by the American Brass Company. A reduction of ½ cent took place on the entire line of brass and copper finished material with the exception of copper in rolls, which was reduced 1 cent. Nickel-silver sheets, wire and rods dropped ¼ cent with the exception of 16 per cent grade A sheets. These were cut ½ cent per pound.

Cowan Truck Company Increases Capacity by 20 per Cent

The Cowan Truck Company, Holyoke, Mass., has made extensive alterations and rearrangements in its plant by which it has increased its production capacity by 20 per cent, and improved efficiency has enabled it to reduce its costs and prices, with the result of largely increased sales. These for the first half of the present calendar year are said to have approached closely those for the first half of 1919, representing the peak of the post-war period.

Barber Company Increases Representation

Weir, Smith & Company, 35 Warren Street, New York City, and Smith & Norrish, 609 Chamber of Commerce Building, Pittsburgh, have been appointed agents for the Barber Electric Manufacturing Company, North Attleboro, Mass. H. C. Barber, president, states that an active and well-dis-

tributed demand is being felt by this company for knife switches, although the company's output of switch boxes is steadily increasing. Business has shown much improvement during the current year.

Bates Expanded Steel Truss Firm Doubles Office Space

Moving from 208 South La Salle Street, to 232 South Clark Street (the Illinois Merchants' Bank Building), the Bates Expanded Steel Truss Company, Chicago, has doubled its office space. At the June directors' meeting a reorganization was effected as follows: President, A. J. Bates; vice-president, Walter A. Bates, and secretary, Albert J. Bates, Jr. Additions have been made in its sales force to provide for more extensive traveling. Sales for the first six months of this year are more than three times those of last year.

Brandes Products Corporation Starts Production

The Brandes Products Corporation, 194 Mount Pleasant Avenue, Newark, N. J., has officially started production at its recently acquired new plant. The corporation has been incorporated for $250,000 to operate as the manufacturing division for C. Brandes, Inc., 237 Lafayette Street, New York City, maker of head sets.

The company occupies a two-story brick building of modern mill construction with a total floor space of about 46,000 sq.ft., which is being rapidly equipped with various types of punch presses ranging from 5 tons to 50 tons capacity. Complete hardening and nickel-plating plants will be installed.

H. Stephenson, plant manager, is in charge of production, with offices at the plant. J. S. Stamp is in charge of the office and accounting. D. H. Moss, director of plants, will maintain his office at 237 Lafayette Street. The Brandes Products Corporation will eventually employ about a thousand persons.

Fuller Engineering Is Now Sole Licensee of Quigley Fuel

An agreement has been consummated whereby the Fuller Engineering Company, Fullerton, Pa., will act as sole licensee in the United States and Canada for all new business of the Quigley Fuel Systems, Inc.

The engineering personnel of the Quigley Fuels Systems, Inc., has become associated with the Fuller Engineering Company, and that staff is now in a better position to render more complete engineering service, as by this arrangement designs can be presented from a wider selection of pulverized-fuel equipment. In the future all business of the Quigley Fuel Systems, Inc., will be handled through the main and branch offices of the Fuller Engineering Company.

New York Electrical Trade Board Arranges Collection Service

In accordance with the resolution adopted June 20 at the meeting of the board of governors of the Electrical Board of Trade of New York, the governors have just completed arrangements with the Credit Clearing House to undertake collections of slow and delinquent accounts for the board's members. This service, the governors state, will be a source of income to the board, while adding nothing to the ordinary charges made for such work by any credit concern.

Westinghouse Bookings Increase $16,000,000 in Two Months

With many of the large electrical manufacturers showing forward business on their books substantially reduced as a result of the slackening of buying, coupled with the high rate of operations maintained, the position of the Westinghouse Electric & Manufacturing Company forms a rather sharp contrast.

This company's unfilled orders have been on the increase, standing at $78,000,000 on July 31 against $61,900,000 on March 31, sales billed in the period approximating $50,00,000. The reason for the sale of additional stock in the spring, which added $15,860,000 fresh funds to working capital, is now plainly evident. Increased demand for electrical equipment was anticipated and preparations were made in advance. For the fiscal year ended March 31 last earnings on the 1,719,250 shares of combined common and participating preferred stock of $50 par value outstanding equaled $6.70 a share, with net sales of slightly more than $125,000,000. From present indications sales this year should aggregate more than $160,000,000.

Recent Ball Park Fire Did Not Damage Driver-Harris Plant

The Driver-Harris Company, Harrison, N. J., manufacturer of resistance wires, wishes to correct the report published in some daily newspapers that the fire which recently destroyed the Newark baseball club structure had damaged its plant. These wrong reports, the company feels, gives the impression that its production has been interfered with.

Consulting Engineering Organizations Affiliate

George B. Nichols, consulting engineer, 300 Madison Avenue, New York City, and the Terrell Croft Engineering Company, of which Terrell Croft is directing engineer, of 6600 Delmar Boulevard, University City, St. Louis, have effected an affiliation whereby the experience and resources of each organization will be available to the clients of the other. Mr. Nichols will act as the principal for projects east of Illinois, whereas the Croft organization will so act for projects west of that state. The combination will specialize in mechanical and electrical engineering for power and industrial plants, institutions and buildings.

Injunction Granted in Water Softener Suit

The Permutit Company, 440 Fourth Avenue, New York City, manufacturer of water-softening apparatus, recently brought suit in the federal court in New York City against the Paige & Jones Chemical Company, 248 Fulton Street, New York City, for infringement of the Permutit Company's patent covering zeolite water-softening apparatus, which had previously been sustained by the District Court at Buffalo and the Circuit Court of Appeals, New York.

At a hearing in July in the federal court Judge Learned Hand granted an injunction against the Paige & Jones Chemical Company restraining it from further manufacturing or selling of infringing apparatus. The first suit in this patent, which was against the Refinite Company of Omaha, Neb., was carried to the United States Supreme Court, which denied a writ of certiorari to review it.

The Interstate Electric Company, New Orleans, manufacturer of electrical supplies, lighting fixtures and automotive equipment, announces the appointment of H. A. Robertson as sales manager. For the past twelve years Mr. Robertson was associated with the Varney Electrical Supply Company of Indianapolis and Evansville, Ind., but he recently resigned to join the organization of the Interstate Electric Company.

The Anaconda Copper Company has announced that it will enlarge its new Akron (Ohio) zinc-oxide refining plant to something like double its present capacity. Ground will be broken within the next few days on this factory unit. The company last year purchased considerable land in North Akron and established the first unit of what ultimately is expected to be a million-dollar plant. The first unit consists of seven buildings, including a garage and office building, and is now operating twenty-four hours a day.

Edward H. Jewett, Penobscot Building, Detroit, and associates have perfected arrangements for the acquisition of a controlling interest in the De Forest Radio Telephone & Telegraph Company, Sedgwick Avenue, New York, for a consideration stated to be $1,000,000. Dr. Lee De Forest, heretofore head of the company, will be succeeded in this capacity by Mr. Jewett, but will continue in active association with the new organization in the development of radio instruments and equipment. Tentative plans are under advisement for general expansion.

Foreign Trade Notes

AN ELECTRIC RAILWAY TO BE BUILT IN POLAND.—A Polish-British company, according to *Commerce Reports*, has been organized to construct electric railways in Poland. The first line will be built between Warsaw, Grodzisk and Zyrardow. Electricity will be secured from the Pruszkow power plant.

AUTOMATIC TELEPHONES PROPOSED FOR IRISH FREE STATE.—The Irish Free State Post Office Department, *Commerce Reports* states, has engaged an automatic telephone engineer to make investigations relative to the installation of automatic telephones.

PROPOSED MUNICIPAL ELECTRIC PLANT FOR LA PLATA, ARGENTINA.—The installation of a municipal electric plant, according to *Commerce Reports*, is under consideration by the Department of Public Works of the municipality of La Plata, Argentina. The proposed plant will be built at the Great Dock, La Plata, and will cost with underground cables for 200 city blocks, approximately $1,300,000. The contract which the city now has with a private company expires in July, 1926.

PROPOSED ELECTRICAL DEVELOPMENTS IN MOROCCO.—Several electric power plants with a total capacity of from 15,000 kw. to 20,000 kw., according to *Commerce Reports*, are included in a proposed program for electrical developments in South Central Morocco (zone of the French protectorate). The plan includes a hydro-electric plant at Sidi-Machou, a steam-power plant at Casablanca and a series of developments in the upper basin of the Oumer-Rbia River. High-tension transmission lines will be erected to connect these stations with a number of phosphate works. The Compagnie des Chemins de Fer du Maroc has undertaken the construction of the plant at Casablanca, which is to be equipped with three 6,000-kw. turbo-alternators. It will be completed during the first quarter of 1924. Preliminary plans for the hydro-electric plant of the Oumer-Rbia River call for a 5,000-kw. unit.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Warsaw, Poland (No. 7,565), for electrical engines.

Purchase and agency is desired in Halifax, Nova Scotia (No. 7,566), for complete radio sets.

Purchase is desired in Mexico City, Mexico (No. 7,546), for the purchase of electric water heaters, etc.

An agency is desired in Chihuahua, Mexico (No. 7,574), for refrigeration equipment.

An agency is desired in Shanghai, China (No. 7,561), for X-ray show-window reflectors.

New Apparatus and Publications

VACUUM-TUBE SOCKETS.—The Walnart Electric Manufacturing Company, 1251 West Van Buren Street, Chicago, has placed on the market a line of vacuum-tube sockets.

COLOR LIGHT UNIT.—The Bright Light Reflector Company, 494 Gates Avenue, Brooklyn, N. Y., has developed a color light unit using glass color films.

CYLINDER BELLOWS.—T. Peiffer, 82 Liberty Street, Newark, N. J., has brought out a cylinder bellows for use in cleaning out electrical machinery.

INDUCTION MOTORS.—The Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, Ohio, has issued bulletin No. 5,018, which describes and illustrates its type AA "Reliance" induction motors for two-phase and three-phase, alternating-current circuits.

ELECTRIC WATER HEATER.—The Automatic Electric Heater Company, Warren, Pa., has developed a storage-type water heater in capacities of 20, 30 and 40 gal.

ELECTRIC HEATER.—The Fitzgerald Manufacturing Company, Torrington, Conn., has placed on the market a new model electric heater, under the name of "Star-Rite."

RHEOSTAT.—The National Electric Controller Company, 154 Whiting Street, Chicago, has developed a rheostat, known as type R3, designed for cabinet or panel mounting.

INDUCTION MOTORS.—The Allis-Chalmers Company, Milwaukee, is distributing bulletin No. 1087D covering its large polyphase induction motors.

THEFT-PROOF BULB.—A new theft-proof electric bulb, "Kulp," that fits into any standard socket, has been developed by Lester Kulp, 143 West Austin Avenue, Chicago.

ELECTRIC TRUCK.—A new electric fork-lift truck for use in warehouse, freight car, pier shed or factory yard has been added to the "Elwell-Parker lift and carry" series of the Elwell-Parker Electric Company, Cleveland.

ELECTROPLATING AND BUFFING APPARATUS.—Catalog No. 10 issued by A. P. Munning & Company, Matawan, N. J., covers the "Munning" electroplating and buffing apparatus and supplies for all industries.

STEEL POLES.—The Bates Expanded Steel Truss Company, 232 South Clark Street, Chicago, is distributing a booklet entitled "Pictured Evidence," which describes and illustrates the use of "Bates" steel poles for transmission systems, including foreign installations, special river crossings, etc.

RECORDER AND INDICATOR.—Bulletin No. 117 issued by the Uehling Instrument Company, Paterson, N. J., illustrates in diagrammatic form the principle of operation of the Uehling CO_2 recording and indicating equipment.

REFERENCE BOOK FOR LIGHTING INDUSTRY.—"Building Store Lighting Business" is the title of a book published by the Society for Electrical Development, Inc., 522 Fifth Avenue, New York City, which is one of a series of permanent reference books, all specially designed to assist the industry to "electrify" by promoting the idea of "do it electrically."

RAILWAY OPERATING DATA.—The first five leaflets in Volume 2 of its "Railway Operating Data Series" have been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These data are for the use of electric railway operators in the care and maintenance of car equipment.

USE OF ELECTRICAL HOUSEHOLD APPLIANCES.—"The Conlon Plan as Applied to Central Stations" is the title of a booklet published by the Conlon Corporation, Chicago, in which it advocates the use of electrical appliances in the home. It contains illustrations comparing the old method with the new. A booklet describing and illustrating the "Incomparable Conlon" washer is also being distributed by the company. The June number (Vol. 1, No. 1) of *The Conlon Medallion*, a house organ, has been issued by the company.

FLASHERS.—The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing bulletin No. 40, covering the "Reco" flashers for electric signs and displays. They are also used for "stop and go" traffic signals, fire-alarm sirens, call systems, special timbers and other automatic contacting work.

INSULATOR UNITS.—Several insulator units for busbar and switch use have recently been added to the line of products of the Ohio Brass Company, Mansfield, Ohio.

AIR FILTERS.—"Dust Problems and Their Solution" is the title of the new "Midwest" air-filter catalog issued by the Midwest Air Filters, Inc., 100 East Forty-fifth Street, New York City, which contains a brief outline of useful information for architects, engineers and plant executives and all others interested in industrial processes.

New Incorporations

THE NORTHEASTERN OHIO POWER & LIGHT COMPANY, Ashtabula, Ohio, has been incorporated with a capital stock of $50,000 by Palmer Wardman, E. R. Gordon, F. L. Sanders and R. D. Wardman.

THE MUTUAL LIGHT COMPANY, Harrisonburg, Va., has been incorporated with a capital stock of $1,500 to erect and operate a transmission line from Harrisonburg to Pleasant Valley Road. The officers are: Samuel H. Callender, Rockingham, Va., president, and N. E. Bowman, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 4, for twenty-seven circuit breakers. (Schedule 1235.)

LAWRENCE, MASS.—Electric power equipment will be installed in the proposed bottling plant to be erected on Beacon Street by the Curran & Joyce Company, Common Street, to cost about $150,000. Ashton, Huntress & Alter, Essex Street, are architects.

TAUNTON, MASS.—The Municipal Lighting Department is considering plans for the construction of two substations on Court Street, to cost about $250,000. Jackson & Moreland, 387 Washington Street, Boston, are engineers.

NEW LONDON, CONN.—The Connecticut Power Company is planning to erect a building on Meridian Street, to cost about $200,000.

Middle Atlantic States

BALLSTON, SPA, N. Y.—The Commissioners of Saratoga County are considering a hydro-electric development and water-supply system for the Homestead Sanatorium, Saratoga County Tuberculosis Hospital, to cost about $50,000. The Utilities Engineering Company, Inc., 467 Broadway, Albany, is engineer.

BUFFALO, N. Y.—The American Lithographic Company, 111 Swan Street, plans to install electric equipment, including motors, etc., at its proposed new plant on Amherst Street, to cost $1,000,000.

COEYMANS, N. Y.—The Public Service Commission has granted the Atlantic Light & Power Company authority to transfer its property and franchises in Bethlehem to the Municipal Gas Company, Albany, to enable the latter company to extend its service there. For details see issue of Aug. 18.

NEW YORK, N. Y.—Electric power equipment will be installed in the proposed ten-story ice and refrigerating plant and industrial building to be erected at Washington and Little West Twelfth Streets by the Fox-Gelberg Holding Corporation, 1254 Fifty-first Street, Brooklyn.

TOMPKINSVILLE, N. Y.—Bids will be received by the Superintendent of Lighthouses until Oct. 9 for one third-order, four-panel flashing lens. (Proposal 15509.)

TOTTENVILLE, N. Y.—The Nassau Smelting & Refining Works, Ltd., 603 West Twenty-ninth Street, New York, contemplates the construction of a power house in connection with a new group of buildings, to cost about $200,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are architects and engineers.

ALLENTOWN, PA.—The Loyalsock, Greenwood and Armstrong Power & Light companies, recently organized, plan to erect a transmission system in portions of Loyalsock, Greenwood and Armstrong Townships. The companies, it is understood, will be operated in conjunction with the Pennsylvania Power & Light Company. P. B. Sawyer and C. M. Walter are principal incorporators. Thomas J. Perkins, Allentown, is representative.

McCONNELLSBURG, PA.—The Todd Electric Light, Heat & Power Company and the Ayr Electric Light, Heat & Power Company have been organized to operate in this district. H. S. Daniels is treasurer of the first-named company and D. H. Patterson of the latter, both of McConnellsburg.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company plans to build an addition to its battery plant at Broad Street and Lehigh Avenue.

READING, PA.—The Metropolitan Edison Company has increased its capital stock from 90,000 to 300,000 shares, part of the proceeds to be used for extensions and improvements, including the construction of an electric generating plant in the vicinity of Middletown.

ROULETTE, PA. — The Roulette Glass Company, Corning, N. Y., recently formed, plans to build a power house in connection with its proposed local plant.

HAVRE DE GRACE, MD.—The Tiger Tire & Rubber Corporation, Equitable Building, Baltimore, recently formed, plans to build a power house in connection with its proposed local plant, to cost $150,000.

ELKINS, W. VA.—The Deep Run Coal Company, Cumberland, Md., plans to install mechanical and electric power equipment at its properties in the Elk Garden district near Elkins. About $300,000 will be expended on the project. Benjamin Robinson, Sr., Frostburg, Md., is engineer.

HUNTINGTON, W. VA.—The City Council contemplates the installation of a street-lighting system in the Westmoreland section.

GRAHAM, VA.—The Blue Stone Furniture Manufacturing Company, recently organized, contemplates the construction of a power house in connection with a new local plant.

HARRISONBURG, VA. — The Mutual Light Company, recently organized, contemplates the installation of a local system for light and power service. A transmission line and substation will be built.

WASHINGTON, D. C.—The construction of a conduit road, hydro-electric plant, filtration plant, reservoir and completion of conduits is under consideration by the United States Engineer Office, Old Land Office Building.

WASHINGTON, D. C.—The Longborough Development Company, 234 Southern Building, contemplates the construction of a power house in connection with a proposed industrial terminal in the West Washington section, to cost about $10,000,000. R. F. Beresford, Southern Building, is architect.

WASHINGTON, D. C.—Plans are under consideration by the Commissioners of District of Columbia for improvements to the street-lighting system, to cost about $1,400,000. John E. Wood, assistant engineer, is in charge.

North Central States

DETROIT, MICH.—Electric power equipment will be installed in the six-story addition to be built by the Detroit Lubricator Company, 5938 Trumball Street, to cost about $325,000. Smith, Hinchman & Grylls, Marquette Building, are architects.

YALE, MICH.—The Detroit Edison Company is negotiating for the purchase of the local municipal electric system.

HAMILTON, OHIO.—The Columbia Gas & Electric Company, Charleston, W. Va., has acquired control of the properties of the Hamilton (Ohio) Service Company, and of the Ohio Gas & Electric Company, Middletown. It is understood that the service of the Columbia Gas & Electric Company will be extended to the town of Hamilton, Middletown, Franklin and nearby communities.

MANSFIELD, OHIO.—The Ohio Brass Company plans to construct a power house at its plant, to cost about $50,000.

LOUISVILLE, KY.—The Louisville Gas & Electric Company plans to increase the output of its power plant on Washington Street to 120,000 hp. The cost is estimated at $500,000.

LOUISVILLE, KY. — The Louisville Hydro-Electric Company has been granted a preliminary permit by the Federal Power Commission to construct a hydro-electric plant at the Ohio River Falls, to cost about $500,000.

COLUMBIA CITY, IND.—Work will soon commence on an addition to the municipal electric and water plant, to cost about $35,000. C. Brossman, Merchants' Bank Building, Indianapolis, is engineer.

FORT WAYNE, IND. — The Thieme Brothers Company plans to erect a power house in connection with extensions at its textile mill, to cost about $75,000.

INDIANAPOLIS, IND. — The Kramer Manufacturing Company, 602 South New Jersey Street, plans to construct a power plant in connection with a new factory, on South LaSalle Street, to cost about $250,000. All machinery at the main works will be motor-driven.

MEROM, IND.—The Knox & Sullivan County Light & Power Company is planning to install a local light and power system for commercial service.

RICHMOND, IND.—The Fibre Conduit Company, Orangeburg, N. Y., has awarded a general contract for the first unit of its proposed local plant, to cost about $400,000. The plans provide for a power house.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation has purchased the Davies Falls water-power site on the Pike River, south of Amberg, where it proposes to build another hydro-electric plant.

GREEN BAY, WIS. — Plans are being prepared by A. E. Kringel, city engineer, for replacing the present steam equipment of the municipal waterworks with gas-engine and electric motor equipment. New pumps will be required. The cost is estimated at $75,000.

IRON RIVER, WIS.—Preparations are being made by the Iron River Water, Light & Telephone Company for rebuilding its dam.

MILWAUKEE, WIS. — The Milwaukee Electric Railway, Light & Power Company contemplates the erection of a transmission line from Fort Atkinson to the Elkhorn-Delavan line, to cost about $40,000. The company also plans to erect a transmission line from its Lakeside plant, Milwaukee, to connect with the plant of the Whitewater (Wis.) Electric Light & Power Company.

WAUSAUKEE, WIS. — The Wisconsin Public Service Corporation, Green Bay, contemplates erecting a transmission line from its Johnson Falls plant to Wausaukee if sufficient business can be obtained to guarantee the expenditure.

WHITEWATER, WIS. — The Milwaukee Electric Railway & Light Company is planning to erect a transmission line from its Lakeside plant, Milwaukee, to connect with the local plant of the Whitewater Electric Light & Power Company.

ST. PAUL, MINN.—Plans are being prepared for the construction of a power house at Macalester College, Grand and Macalester Avenues. W. M. Ingeman, Endicott Building, is architect.

RED WING, MINN.—The construction of a municipal electric plant is reported to be under consideration.

DES MOINES, IOWA.—Plans are being considered for the installation of an ornamental lighting system on Keosauqua Way from Seventh to Fifteenth Streets. A. E. McGlothlen is city clerk.

WASHINGTON, IOWA.—An election will be held Sept. 6 to vote on the proposal to issue $80,000 in bonds for improvements to the waterworks, consisting of a 200,000-gal. elevated tank, complete with pumping station, equipped with electric motor-driven pumps, switchboard etc. Arthur L. Mullergren, Gates Building, Kansas City, Mo., is engineer.

BOLIVAR, MO.—The Council is considering submitting the proposal to issue $45,000 in bonds for a reserve power plant for the power-dam project planned for Sac River at Stockton.

REPUBLIC, MO.—A bond issue of $35,000 is being considered for the installation of an ornamental lighting system.

STOCKTON, MO.—The Stockton Light & Power Company is planning to build a power plant, dam and an 18-mile transmission line from Stockton to Fairplay, to cost about $60,000.

THAYER, MO.—Tentative plans are being considered by the City Council for the installation of deep-well electrical pumping machinery, to cost about $40,000.

WENTZVILLE, MO.—The East Missouri Power Company is planning to install a local system for general commercial service. A franchise is being arranged.

CHANCELLOR, S. D.—A company has been incorporated by A. J. Waltner, R. R. Grebiel and F. C. Gish to finance the erection of a transmission line to furnish electricity to farmers living in this vicinity. It is also proposed to build a line from Marion to Greeman and from there to Menno. The new company, it is understood, has made arrangements to secure energy from the Northern States Power Company, Sioux Falls, to operate the proposed system.

BEATRICE, NEB.—The Black Brothers Flour Mills Company has started work on the construction of a second hydro-electric plant southeast of Beatrice. The company was recently awarded a contract to supply electricity in Wymore.

EMPORIA, KAN.—Extensions are contemplated by the Kansas Electric Power Company to its local plant, including extensions to power plant, underground tank for storing fuel, the installation of switchboard, etc.

Southern States

BETHEL, N. C.—Work will soon commence on the installation of an ornamental street-lighting system on principal thoroughfares of the city.

MOORESVILLE, N. C.—Plans for extensions to the local works of the Cascade Mills, Inc., Lexington, include a 750-hp. power plant. Lockwood, Greene & Company, Charlotte, are engineers.

COLUMBIA, S. C.—The installation of two motor-driven pumps of 12,000,000 gal. capacity each in the municipal waterworks is under consideration.

GREENVILLE, S. C.—Plans are under consideration for the installation of electric pumping equipment in connection with proposed extensions to the municipal waterworks, to cost about $300,000, for which bonds have been voted.

MACON, GA.—The Central of Georgia Power Company is preparing plans for an addition to its hydro-electric plant, to cost about $4,000,000, including steel-tower transmission line.

DELRAY, FLA.—Bonds to the amount of $22,000 have been voted for extensions to the light and water plant, including the installation of a new engine, generator, etc.

ST. AUGUSTINE, FLA.—The Southern Utilities Company is planning to remove the plants of the St. Augustine Ice Company and the St. Augustine Steam Laundry Company from their present location to Riviera Street and to erect new buildings to house them. The ice plant will be 70 ft. x 80 ft., and electrical equipment will be installed. The building for the laundry will be 97 ft. x 75 ft. and will be operated by electricity. New equipment will be installed in the power plant, including a 1,500-kw. steam turbine, boiler, new condenser and switchboard.

STUART, FLA.—The Council is considering calling an election to vote on the proposal to issue bonds for the installation of electric lighting system, waterworks, sewers, etc.

BESSEMER, ALA. — The Harbison-Walker Refractories Company, Farmers' Bank Building, Pittsburgh, contemplates the construction of a power house in connection with its proposed local plant, to cost about $500,000.

DOTHAN, ALA. — Contract has been awarded by the City Council for the construction of a hydro-electric plant at Chalkers Bluff to serve the Brooks Callaway Company, Atlanta, Ga. The work will include a concrete dam, 25-mile transmission line and power station to house two units of 3,000 hp., with provision for two additionl units of same capacity. The total cost is estimated at $800,000. Ludlow Engineers, Inc., Winston-Salem, is engineer.

WATERLOO, ALA.—The H. F. Young Lumber & Land Company, Birmingham, contemplates the construction of a power house at its proposed local lumber plant, to cost about $100,000.

FORT SMITH, ARK.—The Model Window Glass Company contemplates rebuilding its power plant, recently damaged by fire, with loss of about $200,000.

PINE BLUFF, ARK.—Plans for the proposed local textile mill, to be built by a company now being organized, to cost about $900,000, include a power house. J. E. Boyce, Chamber of Commerce, is in charge.

GIBSLAND, LA.—The Council is asking bids for improvements to waterworks and electric lighting system, including one 100-hp. oil engine and 75-kw. generator, directly connected, switchboard, street-lighting regulators, 7½ kw., and thirty series hoods, compressor, motor, two centrifugal pumps with motors, 125 gal. per minute, etc., for air-lift system.

LITTLE WOODS, LA.—The City Commissioners are negotiating with the officials of the New Orleans Public Service Corporation relative to extending its service to Little Woods. Inquiries have also been made relative to the cost of establishing a municipal electric plant. The town already has electric service, but it is not at all satisfactory.

BLACKWELL, OKLA. — The Hazel-Atlas Glass Company, Wheeling, W. Va., plans to build an addition to its power house, to cost about $75,000.

DAVENPORT, OKLA.—The Davenport Clay Company, recently organized, contemplates the construction of a power house in connection with a new local plant. C. A. Noll, Wichita, Kan., is interested in the company.

OWASSO, OKLA.—Plans are being arranged for the installation of electrically operated pumping machinery at the proposed municipal waterworks, to cost about $75,000. The Holaway Engineering Company, Wright Building, Tulsa, is engineer

DALLAS, TEX.—The Texas Power & Light Company plans to construct a substation on Tuttle Street, to cost about $60,000.

MARLIN, TEX.—New interests have purchased the properties of the Central Texas Ice & Light Company, including the light,

power and ice-manufacturing plants at Marlin, Chilton, Rosebud, Riesel, Travis, Mart and Lott. The company will be reorganized and the plants extended and improved.

OAKDALE, TEX.—The Oakdale Ice & Light Company contemplates rebuilding its power plant and ice-manufacturing plant, recently damaged by fire, causing a loss of about $55,000.

Pacific and Mountain States

MOUNT VERNON, WASH. — Allen R. Moore, Mount Vernon, and associates have applied to the State Engineer for permission to build a hydro-electric plant on Swift Creek, a branch of the Baker River, to cost about $100,000. It is purposed to organize a company to operate the system.

SEATTLE, WASH. — The Stetson Post Lumber Company, 5501 Marginal Way, contemplates the construction of a power house in connection with a new local plant, to cost about $100,000.

BAKERSFIELD, CAL. — An ordinance has been approved for an ornamental lighting system in the business section, to consist of 14-ft. steel poles, mounted with single lamps of 400 cp. W. D. Clark is city engineer.

HELM, CAL.—Bids will be received by R. M. Bostwick, secretary Stinson Irrigation District, until Sept. 4 for improvements, including (1) 10-20 vertical-shaft motors, etc.; (2) 3-6 horizontal-shaft induction motors, etc.; (3) 3-6 deep-well turbine or propeller pumps, etc.; (8) 15-20 deep-well pumps and motors, etc.; cement, metal gates, construction of bridges, etc. Code & Hill, Hollingsworth Building, Los Angeles, Cal., are consulting engineers.

LOMPOC, CAL.—Steps are being taken for the installation of an ornamental lighting system on the principal streets.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company has issued bonds for $4,000,000, part of the proceeds to be used for extensions and improvements.

ORANGE, CAL.—The Western Cordage Company contemplates the construction of a substation in connection with its proposed plant on West Palm Avenue, to cost about $125,000.

REDLANDS, CAL.—Plans are under consideration for the installation of an ornamental lighting system on Myrtle Avenue between Olive and Fern Avenues.

SACRAMENTO, CAL. — Bids are being received by the City Commission for a fire-alarm system, to cost about $25,000. A. Givan is city engineer.

SANTA ANA, CAL. — Plans are being considered for the installation of an ornamental lighting system on North Broadway and South Main Street.

SANTA ANA, CAL.—The Southern California Edison Company has acquired property adjoining its substation on South Main Street and will build an addition, to cost about $40,000.

STOCKTON, CAL.—Bids will be received by the College of Pacific, care of Davisis-Heller-Pearce Company, architects, Delta Building, Stockton, after Sept. 1, for construction of science building, dining hall and gymnasium, auditorium, boys' dormitory and girls' dormitory, power house and stadium, to cost about $600,000.

UKIAH, CAL. — The Eureka Electric Company has applied for a twenty-five-year franchise to erect a transmission line in Round Valley.

Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company is considering extending its high-transmission line to Nanaimo and Ladysmith.

NORTH YORK TOWNSHIP, ONT.—By-laws will be submitted to the ratepayers in Hydro areas 1 and 2 on Sept. 8 providing for Hydro installation. The cost of the installation in Area No. 1 is estimated at $70,000, and in Area No. 2 at $18,000.

DRUMMONDVILLE, QUE. — Contract for construction work in connection with the deveyopment of the power sites at Hennings Falls, near Drummondville, on the St. Francis River, has been awarded to the Foundation Company, Ltd., of Canada. The plans call for a development of 30,000 hp. The purchase of building materials will be in charge of the contractors, and the machinery and equipment will be purchased through the purchasing department of the Southern Canada Power Company, Ltd., Coristine Building, Montreal.

HULL, QUE.—The Ottawa & Hull Power Company, Ltd., is planning a new development at Calumet, about 50 miles up the river from Ottawa.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 7, 1923)

1,464,243. ANTI-THEFT DEVICE FOR ELECTRIC LAMP BULBS; T. A. Dickinson, Youngstown, Ohio. App. filed April 22, 1922.

1,464,245. CONTROLLER FOR ELECTRIC MOTORS; C. E. Fairburn, London, England. App. filed Sept. 22, 1920. For motors required to work on two or more circuits having different characteristics.

1,464,255. ELECTRICAL HEATING DEVICE; R. F. Zimmermann, Buenos Aires, Argentina. App. filed July 14, 1922. Resistance wire wound spirally on dry calcined non-fusible material.

1,464,274. CONNECTOR FOR RADIO EQUIPMENT; S. Storch, Brooklyn, N. Y. App. filed May 15, 1922. "For three-coil mountings."

1,464,280. ELECTRIC HEATER; L. P. Hynes, Albany, N. Y. App. filed Jan. 25, 1922. For railway and other vehicles.

1,464,304. FILAMENT CLAMPER; J. B. Whitmore and J. E. Ferguson, Bloomfield, N. J. App. filed Sept. 3, 1921. For securing the filaments to the leading-in wires of lamps.

1,464,312. ELECTRICAL RESISTANCE ELEMENT; F. A. Fahrenwald, Cleveland, Ohio. App. filed Sept. 30, 1921. Composed of iron alloy, chromium and a metal of the titanium group.

1,464,322. RADIO RECEIVING METHOD AND APPARATUS; F. A. Kolster, Washington, D. C. App. filed Nov. 28, 1920. Apparatus for transmitting undamped electro-radiant energy waves.

1,464,346. VARIABLE ELECTRIC LAMP; J. Ardo and F. Melfo, Newhall, W. Va. App. filed Sept. 21, 1921. Dimming device built into lamp.

1,464,382. ELECTRIC LAMP; R. M. Eaton, Niagara Falls, N. Y. App. filed Jan. 26, 1922. Portable flashlights.

1,464,402. SOCKET COVER; M. Berman, Brooklyn, N. Y. App. filed June 16, 1921. For use either with ball or spherical lamp.

1,464,413. RENEWABLE PRIMARY DRY-CELL BATTERY; W. S. Doe, Kent, Ohio. App. filed May 2, 1921. For flashlights.

1,464,455. ATTATCHMENT FOR TELEPHONES; A. B. Toppan, Watertown, Mass. App. filed Nov. 13, 1922. Sanitary attachment for mouthpiece.

1,464,468. ELECTRICAL CONNECTOR; H. A. Douglas, Bronson, Mich. App. filed March 13, 1919. For miniature light bulbs.

1,464,470. ELECTRIC CONTROLLING DEVICE; W. W. Drummond, Fort Collins, Col. App. filed Jan. 23, 1920. For typesetting and other machines using a controlling keyboard.

1,464,487. RHEOSTAT SOCKET; C. B. King, Detroit, Mich. App. filed April 13, 1922. Electron-tube socket and rheostat built in one unit.

(Issued Aug. 14, 1923)

1,464,496. ELECTRIC FURNACE; C. A. Cadwell, Cleveland, Ohio. App. filed April 29, 1920. Muffle or reheating furnace.

1,464,503. FREQUENCY CHANGER; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 19, 1919. Auxiliary distributed winding on armature improves commutation.

1,464,506. ELECTROLYTIC PROCESS; J. S. Groff, Newport, R. I. App. filed Aug. 18, 1920. For coating metal vessels as protection against corrosion.

1,464,509. TROLLEY FROG; W. Schaake, Pittsburgh, and F. H. Miller, Wilkinsburg, Pa. App. filed July 30, 1920. Means for clamping renewable approach members to frogs.

1,464,514. BATTERY-TESTING INSTRUMENT; C. W. Terry, Detroit, Mich. App. filed Oct. 31, 1919. By voltmeter.

1,464,519. SIGNALING SYSTEM; H. J. Vennes, New York, N. Y. App. filed July 16, 1918. Multiplex carrier-current systems.

1,464,533. RADIO RECEIVING SYSTEM; Siegmund Loewe, Berlin, Germany. App. filed Aug. 26, 1921. Multistage amplifiers used with vacuum-tube detectors.

1,464,535. TROLLEY-CONDUCTOR HANGER; J. P. L. McGivern, Wilkinsburg, Pa. App. filed Feb. 26, 1921.

1,464,538. SWITCH; E. K. Read, Wilkinsburg, Pa. App. filed Feb. 15, 1919. Operating mechanisms for disconnecting switches.

1,464,543. ELECTRIC FURNACE; Marius Sauvageon, Paris, France. App. filed April 2, 1921. Resistance type.

1,464,552. VANITY BOX; Eleanor A. Warner, St. Paul, Minn. App. filed July 3, 1922. Electrically lighted.

1,464,563. REPEATER-CONTROL ARRANGEMENT; C. S. Demarest and O. H. Loynes Woodbridge, N. J. App. filed Feb. 26, 1921. Repeater apparatus at intermediate station automatically controlled from terminal station.

1,464,565. CALL SYSTEM FOR RADIOTELEPHONY; Lloyd Espenschied, Queens, N. Y. and Ralph Brown, East Orange, N. J. App. filed April 13, 1921. Remote control of mechanism by radio transmission.

1,464,573. FLASHLIGHT AND BATTERY THEREFOR; G. W. Heise, Elmhurst, and H. H. Thompson, Flushing, N. Y. App. filed July 15, 1922. Means for variation in number of cells in circuit.

1,464,602. LAMP SOCKET; Ciriaco Garcillan, New York, N. Y. App. filed June 5, 1920. Simple construction.

1,464,618. ELECTRIC HEATER FOR OIL WELLS AND THE LIKE; R. S. Pershing, Fort Worth, Tex. App. filed Sept. 11, 1920. Comprises series of interchangeable heater units.

1,464,620. SUPPORTING BAR FOR TERMINAL BOXES; F. A. Tefft, Toledo, Ohio. App. filed Nov. 28, 1921. For fastening to studding or joists.

1,464,625. ELECTROLYTE FOR ALUMINUM PRODUCTION AND METHOD OF PREPARING SAME; Aladar Pacz, Cleveland Heights, Ohio. App. filed March 18 1920.

1,464,631. REEL FOR CONDUCTING CORDS; F. J. Spuehler, Toledo, Ohio. App. filed Sept. 28, 1921. For electric irons and other electrical appliances.

1,464,663. IMPULSE COUPLING; Adolph Rosner, Springfield, Mass. App. filed July 22, 1921. For use with magnetos.

1,464,689. ELECTROLYTIC CELL STRUCTURE; W. G. Allan, Toronto, Ontario, Canada. App. filed Sept. 2, 1920. For production of hydrogen and oxygen from water.

1,464,703. HEATING ELEMENT; L. J. Fuller, Brooklyn, N. Y. App. filed Feb. 2, 1922. Type designed to be submerged in liquid.

1,464,714. ENGINE-STARTING APPARATUS; A. A. Kent, Ardmore, Pa. App. filed May 22, 1920. Starting motor.

1,464,719. TELEPHONE-EXCHANGE SYSTEM; A. E. Lundell, New York, N. Y. App. filed Sept. 21, 1918. Arrangement for controlling selectively operable switches.

1,464,726. TELEPHONE-EXCHANGE SYSTEM; Lipa Polinkowsky, Antwerp, Belgium. App. filed April 30, 1920. Machine-switching mechanism.

1,464,782. ELECTRIC HEATING APPLIANCE OF THE IMMERSED-ELEMENT TYPE; Walter Stubbs, Mascot, New South Wales, Australia. App. filed Jan. 31, 1922. Heating element brought into direct contact with liquid.

1,464,806. SIGNALING APPARATUS; Colin J. Campbell, Newark, N. J. App. filed March 18, 1920. Rear direction signals for automobiles.

1,464,826. ELECTRIC INCANDESCENT LAMP; Anton Lederer, Vienna, Austria. App. filed May 16, 1914. Process of manufacture.

1,464,838. PRIMARY BATTERY AND PROCESS OF MAKING THE SAME; Henry Wilhelm, Brooklyn, N. Y. App. filed Dec. 31, 1918.

1,464,840. ELECTROLYTIC APPARATUS; W. G. Allan, Toronto, Ontario, Canada. App. filed Sept. 13, 1920. Electrolytic production of oxygen and hydrogen from water.

1,464,857. RHEOSTAT; H. N. Wade, Milwaukee, Wis. App. filed July 1, 1918. Fluid type.

1,464,862. METHOD AND APPARATUS RELATING TO THE PRODUCTION OF METALS; C. W. Balke, Highland Park, Ill. App. filed Feb. 10, 1919. Utilizes electric furnace.

1,464,894. SIGNALING DEVICE; J. W. Webb, Chicago, Ill. App. filed April 6, 1922. Rear direction signal for automobiles.

1,464,911. ELECTRIC MOTOR; G. H. Leland, Dayton, Ohio. App. filed March 10, 1920. Single-phase motor of repulsion starting and induction running type.

1,464,952. TYPEWRITER ATTACHMENT FOR TELEGRAPH SYSTEMS; Donald McNicol, New York, N. Y. App. filed Aug. 23, 1919.

1,465,007. ELECTRIC TOASTER; Ernest Sjolin, Chicago, Ill. App. filed March 9, 1922. Horizontal type with method of reversing toast.

1,465,034. PROCESS FOR THE ELECTROLYTIC DEPOSITION OF COPPER; F. L. Antisell, Perth Amboy, N. J. App. filed Nov. 3, 1921. From cupriferous electrolytes.

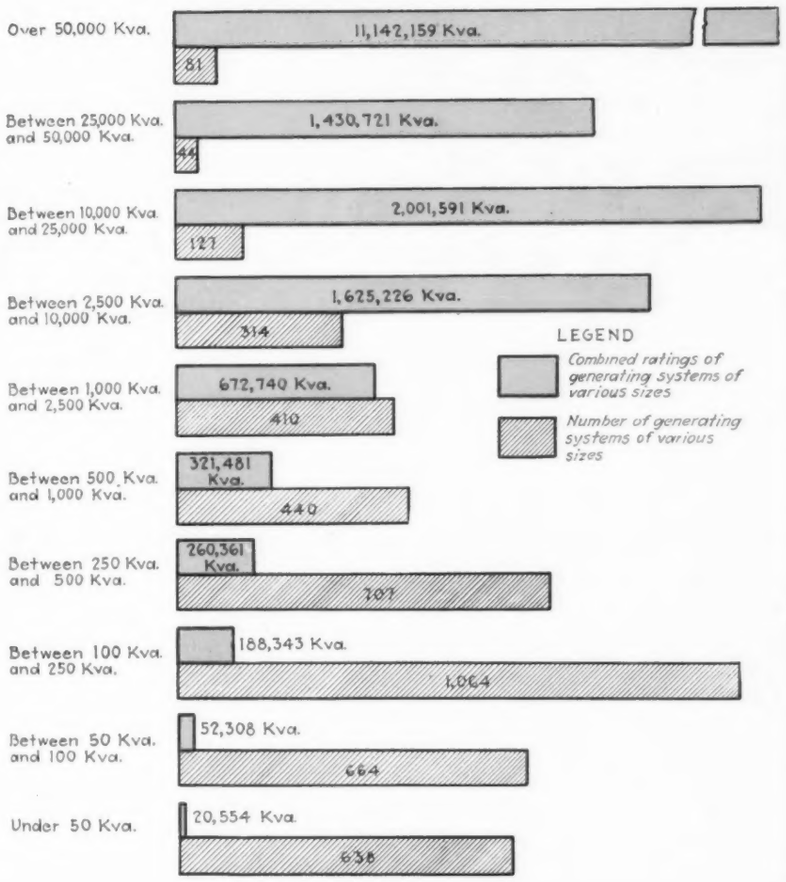
1,465,042. CARBON HOLDER FOR PICTURE PROJECTORS; A. S. Hruska, Detroit, Mich. App. filed April 16, 1921.

1,465,081. ELECTRIC MACHINE; Frank Holden, London, England. App. filed June 24, 1920. Electromagnetic mechanism for driving clockwork.

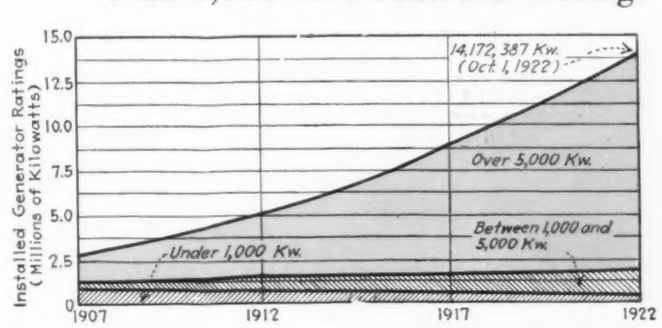
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Less than 2 per Cent of the Total Number of Generating Companies Operate 63 per Cent of the Generator Rating of the Country



Growth in the Central-Station Industry Has Been Confined Almost Entirely to Systems of More than 5,000 Kw. Generator Rating



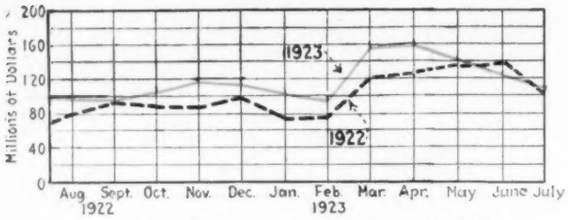
The Advent of Superpower Generating Systems

THE recent history of the electric light and power industry might truly be said to portray a period of concentration, of gathering together loose ends to form a cohesive force for public service. Superpower generating plants have come into being, transmission webs have enveloped the country eliminating large numbers of small inefficient generating plants, and large holding organizations have absorbed operating companies until it has been estimated that at the present time, 95 per cent of the generator rating of the central-station industry is indirectly controlled by such administrative corporations. Considering the local generating companies as distinct from the holding companies, the latest data indicate that less than 2 per cent of the total number of generating companies of the country operate 63 per cent of the total generator rating.

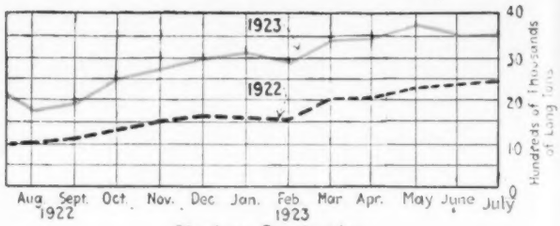
Growth in the central-station industry has been confined almost entirely to systems of more than 5,000 kw. rating. Back in 1907, only sixteen years ago, the total rating of systems with a generator rating under 5,000 kw. was 1,524,000 kw., or 30 per cent of the total generator rating of the country. Today the rating of such systems has increased only to 2,130,000 kw., while the percentage has decreased to only 15 per cent of the total. It is probable that in 1907 there was not a system with a total rating of more than 50,000 kva., whereas at the present time there are eighty-one such companies, representing a combined generator rating of 11,142,159 kva., or about 63 per cent of the total rating of the country. When it is also remembered that in 1922 there were eighty-six electric light and power companies with an annual output of more than one hundred million kilowatt-hours, the bigness of the companies operating in industrial and thickly populated centers is made apparent.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

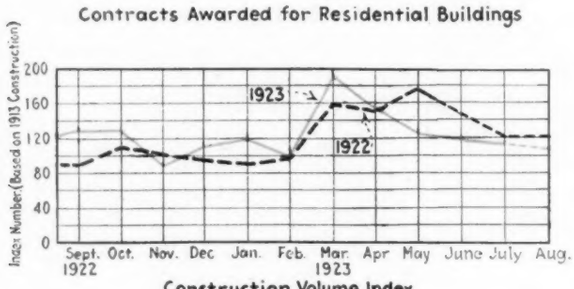
How the Primary Industries Are Trending



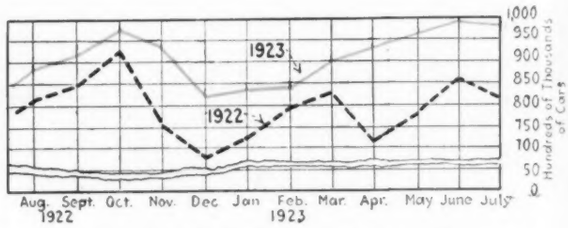
Contracts Awarded for Residential Buildings



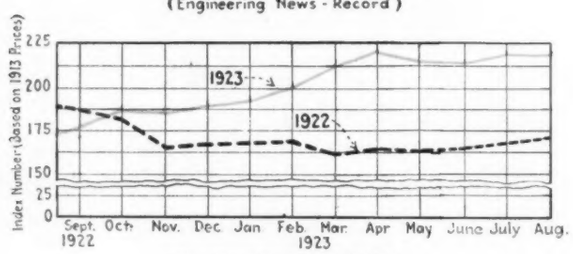
Pig-Iron Production



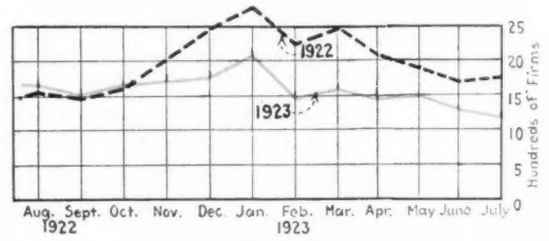
Construction Volume Index
(Engineering News-Record)



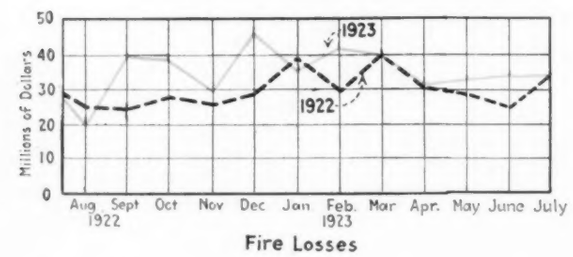
Total Average Weekly Freight-Car Loadings



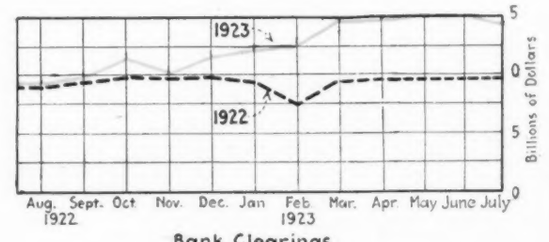
Construction Cost Index
(Engineering News-Record)



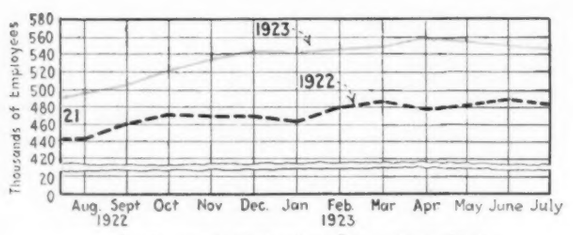
Business Failures



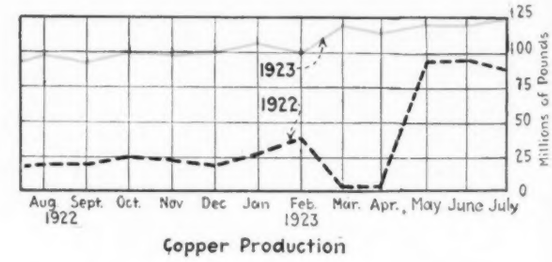
Fire Losses



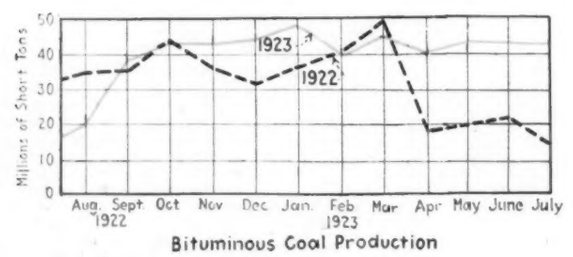
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Business Conditions Generally Sound

ECONOMISTS appear to agree that, considering the chaotic disturbances abroad, midsummer business in the United States has been remarkably well sustained. As the Irving Bank of New York reviews present conditions, "Railroad traffic is excellent, building construction continues on a vast scale, losses through failures are not large, domestic credit conditions are generally sound, liquid capital is in abundant supply, and retail trade continues at a very high level."